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ORIGINAL RESEARCH

Treatment of Colorectal Cancer: a Multidisciplinary Approach

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Abstract

Background Colorectal cancer is the third most prevalent cancer in the world, preceded by prostate and lung cancers in men (10%) and breast and lung cancers in women (9.4%). Colorectal cancer is the fourth leading cause of death in men (7.6%) and the third in women (8.6%). A multidisciplinary approach has radically changed the way we deal with this disease among all specialist fields.

Purpose In this study, we propose comparing the multidisciplinary experience group (started in 2012) of S. Anna Hospital (University of Ferrara) with the previous approach to rectal cancer before the advent of the multidisciplinary program.

Results We find that more study depth of neoplastic disease as well as of each individual patient leads to more accurate staging and to a weighted therapy based on the needs of the individual. All the studies were performed in accordance with the guidelines established by the European and Italian associations.

Keywords Colorectal cancer · Multidisciplinary group · Laparoscopic surgery

Introduction

Colorectal cancer is the third most prevalent cancer worldwide, preceded by prostate and lung cancers in men (10%) and by breast and lung cancers in women (9.4%). Colorectal cancer is the fourth leading cause of death in men (7.6%) and the third in women (8.6%). Overall, 72% of these cancers occur in the colon, and only 28% are rectal; however, from an epidemiological and pathophysiological perspective, both neoplasms can be grouped together.

The multidisciplinary approach has radically changed the way we deal with this disease among all specialist fields [1]. The evidence has increasingly shown that, in regard to tumors, this type of approach presents profound advantages. Emilia Romagna is attempting to encode a standardized path for patients suffering from cancer of the colon and rectum. The growing number of studies in favor of multidisciplinary approaches [2, 3] supports evidence-based medicine and thus allows the implementation of proven and effective therapies. The approach progressed from a rapid and brief assessment of the tumor followed by adjoining surgery to a thoughtful study of the lesion through the use of conventional CT, MRI, and EUS virtual colonoscopy. This methodology was introduced with the intent of providing more data for each patient, thus enabling better understanding of both the primitive and potential secondary pathologies.

After proper study of the disease, multidisciplinary therapy includes the interaction of the surgery with oncology and radiation therapy, basic pillars, and radical surgery.

Although the number of firms opting for non-surgical treatment of rectal cancer is increasing, this method seems to be a distant reality, especially for more advanced stages of the disease [4].

With this study, we propose comparing the multidisciplinary experience group (started in 2012) of S. Anna Hospital (University of Ferrara) with that of rectal cancer patients prior to the advent of the multidisciplinary program. Our results demonstrate that more study depth of neoplastic disease as well as of each individual patient leads to more accurate staging and to a weighted therapy based on the needs of the individual. All the studies were performed in accordance with the guidelines established by the European and Italian associations.

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Materials and Methods

The Operative Unit of General and Thoracic Surgery joined the multidisciplinary program for cancer of the *Colon rectum* Arcispedale S. Anna of Ferrara in 2012.

The specialists (surgeons, pathologists, gastroenterologists, oncologists, and radiotherapists) from different disciplines met every week in a path called PDTA (Percorso Diagnostico Terapeutico Assistenziale), which means "Path Diagnostic Therapeutic Care." We conducted a retrospective study that took into consideration all the patients who underwent surgery of the rectosigmoid junction and rectum from January 2007 to April 2017. The following patients were excluded:

- all patients operated on for tumors not primitively rectum and rectosigmoid junction in nature,
- all patients operated on for non-neoplastic disease (complicated diverticular disease),
- all patients operated on under urgent care.

As a result, our study consisted of a group of 96 patients, of whom 59 were males and 37 females, with a mean age of 68 years (minimum 37 and maximum 86) that underwent surgery for colorectal neoplastic disease between February 2007 and April 2017.

These patients were divided into two groups: patients operated on from February 2007 to December 2011 and patients operated on from January 2012 to April 2017, thus dividing the patients who were followed through the multidisciplinary approach (after 2012) from those that received an approach without a multidisciplinary organization.

Patient data were collected through the following:

– the SAP (Systeme, Anwendungen, Produkte in der Datenverarbeitung) database of the hospital
– the archive of scanned folders to e-care CUP (centro unico di prenotazioni) 2000
– the archive of paper folders managed by Plurima S.p.A

All the collected data were then processed and investigated with Microsoft Excel (15:15 version). The first evaluation of our patients and their illness was decided by proctosigmoidoscopy and a colonoscopy. With these tests, it was possible to localize the tumor and perform a diagnostic biopsy.

Radiological examinations carried out for the evaluation of the tumor were as follows: computed tomography, nuclear magnetic resonance, and eco-digestive endoscopy.

Following the radiological study of the tumor, a neoadjuvant chemotherapy and radiotherapy were then used, when necessary.

The main surgical technique performed by our group was resection of the rectum with a laparoscopic approach. The two main procedures were as follows: anterior resection of the rectum with total mesorectal laparoscopic excision and abdominoperineal amputation according to Miles with total mesorectal excision.

The intestinal tract resected during surgery was analyzed by the pathologist of the Department of Diagnostic Imaging and Laboratory Medicine to evaluate the following: histotype, degree of differentiation, infiltration of the resection margins, regional lymph nodes, Dukes's grade, TNM stage, and genetic investigations.

For the study and analysis of patients with rectal cancer, we considered different parameters, such as age, body mass index (BMI), colonoscopy, ASA core (American Society of Anesthesiologists) class, hospital stay, neoadjuvant therapy, type of surgery, tumor stage, complications, and metastasis. The preoperative studies performed were TC (computed tomography), magnetic resonance, and eco endoscopy.

Results

The Group Analysis

Considering the type of approach, multidisciplinary or not, the group of 96 patients was divided into two subgroups: one group of patients operated on between February 2007 and December 2011 and the second with patients operated on between January 2012 and April 2017.

The sample, consisting of 37 females and 59 males, did not present statistically significant gender differences (Table 1).

The patients had an average age of 68.39 years; the pre-multidisciplinary group had an average age of 69.62 years, while the group that followed a multidisciplinary approach had an average age of 67.31 years.

There were no significant differences in the average ages of the patients before and after the multidisciplinary approach between the two groups.

The mean BMI of the patients was 26.2; there were no statistically significant differences between the two groups (Chart 1).

The analysis of sex, age, and BMI did not report statistically significant differences (Chart 2).

Table 1 Patient cohort analyzed divided by sex

	Pre PDTA*	Post PDTA*	Total
F	20	17	37
M	25	34	59
Total	45	51	96

*PDTA: Percorso Diagnostico Terapeutico Assistenziale (Path Diagnostic Therapeutic Care)

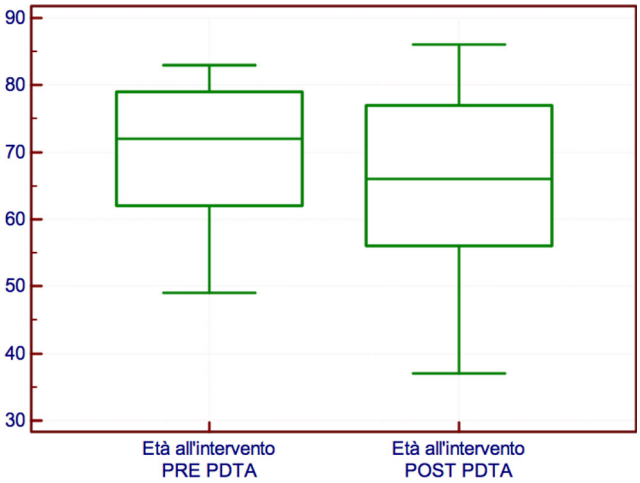

Chart 1 Age analysis of the patients at before and after the introduction of multidisciplinary approach

All the patients were hospitalized for a variable period at the Institute of General and Thoracic Surgery of Sant'Anna Hospital in Ferrara until 2013 and in Cona from 2013 to April 2017. The average time of hospitalization was 12.87 days.

No statistically significant differences in ASA class were found between the two analyzed groups (Chart 3). The average ASA score (American Society of Anesthesiologists) of the patients was 2.4. As seen from the chart, the patients with an ASA class 1 were patients without comorbidities. Most of the patients had other moderate systemic disorders (ASA 2) or serious systemic disorders that can affect patient survival (ASA 3) (Chart 3).

Study of the Tumor and Staging

For the initial assessment of the disease, most patients underwent a colonoscopy with biopsy that allowed evaluation of the presence of malignant cells in the rectum. Not all patients received a colonoscopy, and some received an incomplete colonoscopy due to the inability to overcome the tumor, either resulting from a tortuous anatomical conformation of the large intestine or bowel or from improper cleaning of the intestinal tract (Chart 4).

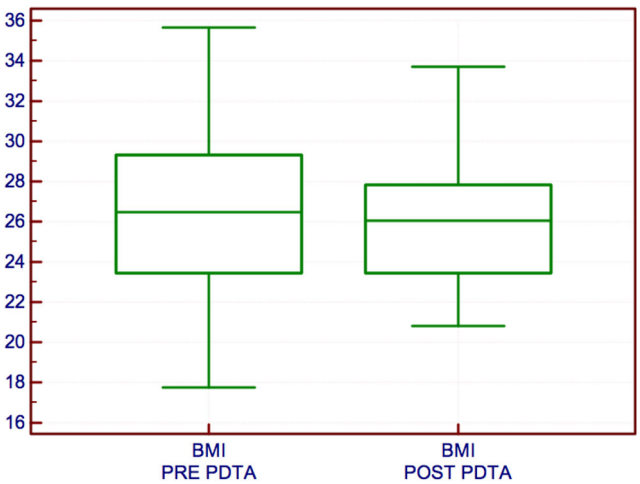

Chart 2 Analysis of body mass index of the patients at before and after the introduction of multidisciplinary approach

As Chart 4 shows, colonoscopy is a fundamental tool for patients with rectal cancer, as the majority of patients that were operated on after the advent of the multidisciplinary approach (in the graph indicated with post-PDTA) had received this diagnostic test. In contrast, only 26 of 45 patients in the pre-PDTA group received a colonoscopy.

Following the diagnosis, especially under the multidisciplinary approach, a thorough study of the tumor was performed with CT, MRI, and eco-digestive endoscopy.

We divided the patients into two groups to see if radiological insights were achieved in both the multidisciplinary approach group and the previous group.

As can be seen in the graph below, the disparity between the pre-PDTA and post-PDTA groups was noteworthy, as we observed differences upon analyzing the individual diagnostic tests.

In regard to the CT, MRI, and eco-digestive endoscopy, use of the multidisciplinary approach greatly increased the application of these techniques, as visually summarized in Chart 5.

Computed Tomography

Only 24.4% of the patients in the pre-PDTA group received a CT scan before surgery. The patients in the post-PDTA group instead received this examination in 82.4% of cases. The difference between the two groups was statistically significant (Chart 6).

Nuclear Magnetic Resonance

The discrepancy between the two groups was even more evident when comparing the use of nuclear magnetic resonance, which was employed on only two patients who had pelvic nuclear magnetic resonance (RMN) (or MRI) before 2012 (pre-PDTA), while 32 of 51 patients (62.75%) received this examination under the multidisciplinary approach. The discrepancy between the two groups was evaluated using Fisher's exact test, which showed a statistically significant variance between the two groups (Chart 7).

Digestive EUS

In the case of the study with digestive EUS, however, there were no significant differences. In our group, the first EUS was performed in the study of colorectal neoplastic disease in January 2010. Seven patients out of 45 carried out this exam in the pre-PDTA group, while 12 of 51 subjects carried out this diagnostic test in the post-PDTA group (Chart 8).

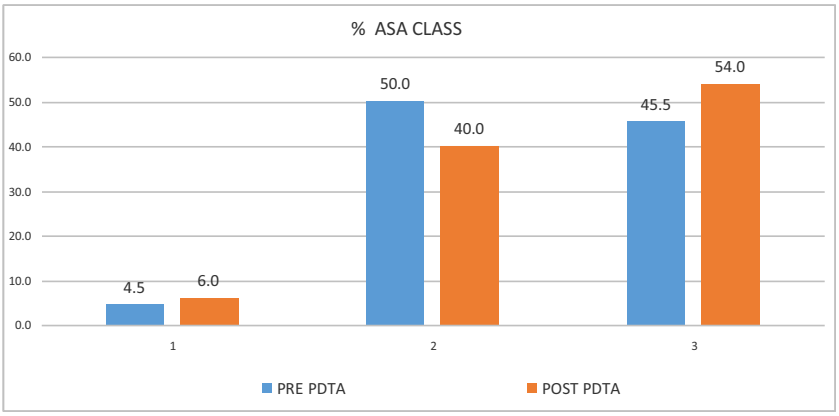

Chart 3 ASA (American Society of Anesthesiologists) before and after the introduction of multidisciplinary approach

The anatomopathological staging used was TNM. In the post-PDTA group, there was an increase in cases at stage IIA and IIIA (Chart 9).

As shown in Chart 9, patients were evenly distributed between the various tumor stages, with the exception of patients with stage 0. The 18 patients in stage 0 that had undergone surgery were divided into two categories:

- Patients who did not have cancer cells but rather had dysplastic cells or carcinoma in situ;
- Patients who fully responded to neoadjuvant therapy and therefore did not have cancer cells in their surgical specimen (Chart 10).

Neoadjuvant Therapy

Neoadjuvant therapy was performed on 39 patients in total.

In the evaluation of patients who had undergone neoadjuvant chemo-radiotherapy, there was a statistically significant difference between the pre- and post-PDTA groups. Although the neoadjuvant therapy was introduced in 2010, only 10 out of the 45 patients in the pre-PDTA group received the therapy. Not all patients had performed neoadjuvant therapy for locally advanced disease or nodal disease. However, neoadjuvant therapy was also performed for patients in stage I (Chart 11).

Surgical Therapy

Surgery was performed mainly with a laparoscopic approach, and the procedures included the following:

- Resection of the rectum with total mesorectal excision
- Abdominoperineal amputation according to Miles

According to the international literature, the most radical intervention performed in the case of rectal cancer was the laparoscopic anterior resection of the rectum with total mesorectal excision. There were 13 cases that required abdominal-perineal amputation (12 laparoscopic and 1 laparoscopic converted to laparotomy). Abdominoperineal amputation was most frequently performed due to a lower rectal lesion that did not allow adequate distal resection margins when performed with an anterior resection (Chart 12).

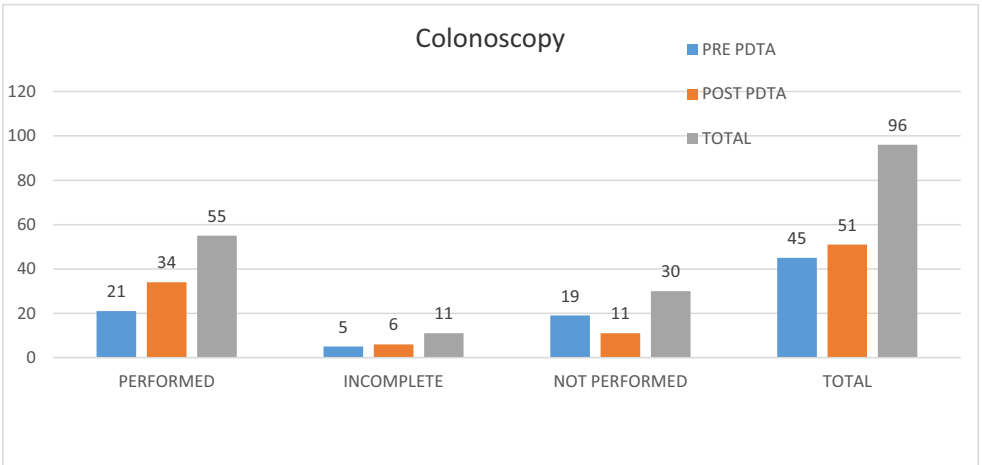

Chart 4 Patients undergoing colonoscopy before and after the introduction of multidisciplinary approach

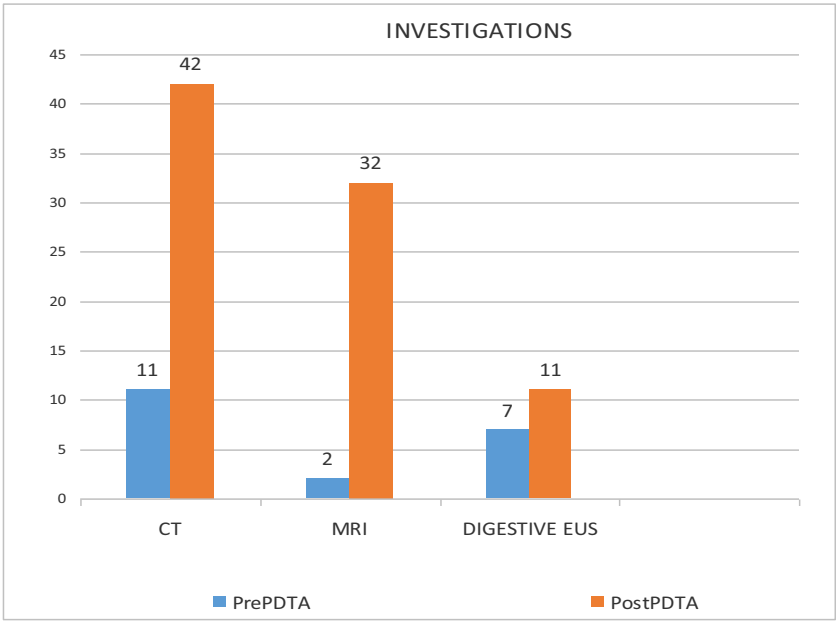

Chart 5 Analysis of diagnostic tests performed for the study of the disease before and after the introduction of multidisciplinary approach

Discussion

Rectal cancer is the seventh most common cancer both in men (3.7% of all cancers) and women (3.3%). In the population considered by the Italian Association for the Registers of Tumors (AIRT) between 1998 and 2002, the incidence of rectal cancer was 28.6/100.000 inh./year for men and 20/100.000 inh./year for women. The most frequent histological type was adenocarcinoma (67–74% of all occurrences) followed by not otherwise specified malignant tumors in 10–11% of the cases. Digital rectal adenocarcinoma is an important cause of cancer-related death in the world, and it is important to emphasize that there are significant differences between the colon and the rectum from an anatomical and clinical perspective, which has an impact on the actual management of the cancer.

Currently, the introduction of new diagnostic, staging, and therapeutic (surgical and non-surgical) methods is steadily increasing, and it is leading to the need and desire to create new approaches that extend beyond surgery and are as diverse as possible.

The purpose of this paper was to give an overview of the diagnosis, staging, and multimodal therapy in patients with rectal cancer. The multidisciplinary approach has been introduced in several Italian regions, including Emilia Romagna, to study and stage the patients and their tumors.

The need for the most complete diagnostic techniques has led to the integration of imaging techniques within the study of cancer. In particular, three imaging methods are currently used in rectal cancer: computed tomography, nuclear magnetic resonance, and ultrasound endoscopy.

The endoscopic trans-rectal ultrasound and magnetic resonance imaging are especially useful tools in the detection of

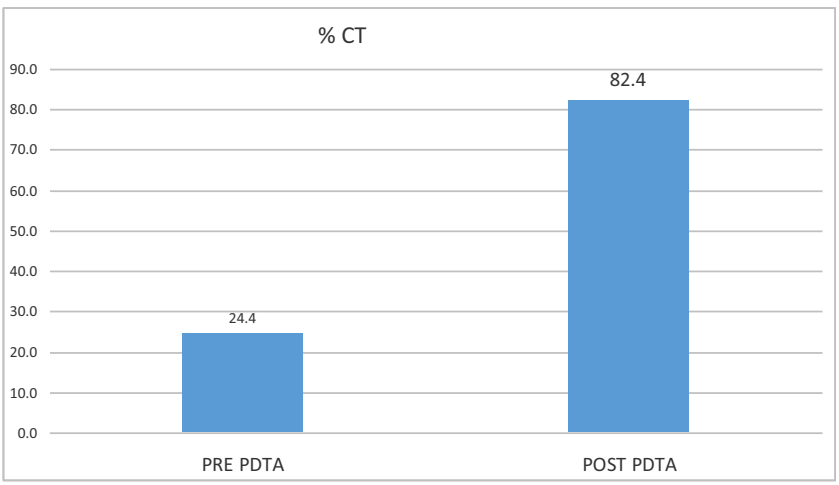

Chart 6 Percentage of patients who performed a CT scan before and after the introduction of multidisciplinary approach. $P < 0.01$ evaluated using the chi-square test

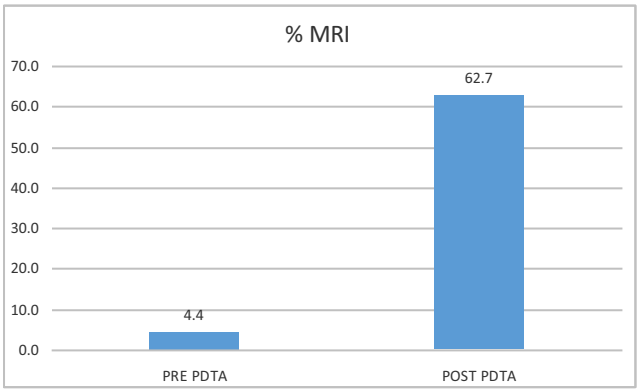

Chart 7 Percentage of patients who performed an RMN before and after the introduction of multidisciplinary approach. $P < 0.01$ evaluated with Fisher's exact test

the tumor outside of the rectal wall and in predicting the relationship between the tumor and the circumferential resection margins. A correlation between histopathology and MRI in predicting the stage of the tumor was highlighted by several cases, including a prospective study by Brown et al. [5], showing a correlation of 94% between MRI and the pathological evaluation of T stage. In our group of patients, 34 received a preoperative MRI to stage the tumor. Among these, only 2 were performed before the multidisciplinary approach, while the remaining 32 were carried out after January 2012. In our case, the correlation between the size of the tumor before the operation and that evaluated on the resected piece coincided in 24 of 34 cases, which equals 70.6% of the cases.

In a meta-analysis that included data from 90 publications, Bipat et al. [6] showed that the sensitivity of endoscopic ultrasound and magnetic resonance outside of the rectal wall was 90% and 82%, respectively. In contrast, the sensitivity dropped sharply in the lymph node, rating 67 and 66%. The assessment of nodal status using MRI on our 34 patients confirmed the state of resected lymph nodes in 28 of 34 cases (82.35%). Magnetic resonance in our series did not follow the percentages published in the literature in the evaluation

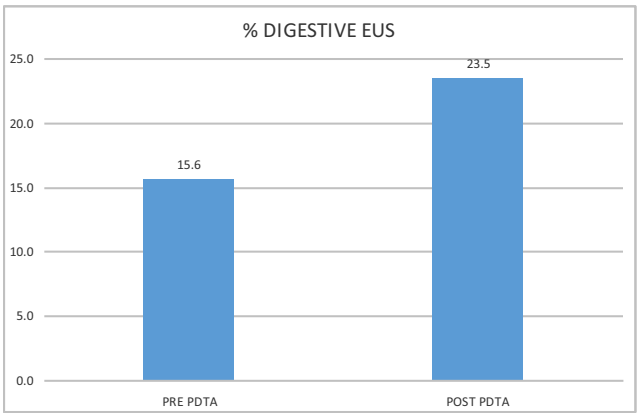

Chart 8 Percentage of patients who performed digestive EUS before and after the introduction of multidisciplinary approach. *P* not significant

of primary tumor stage; however, it proved to be a valid tool for assessing the nodal status.

EUS staging was instead performed on 19 patients for preoperative evaluation. The assessment of the primary tumor stage was accurate in 16 of 19 cases (84.2%). In the remaining 3 cases, the tumor mass had been overstaged by the EUS method.

In the nodal status evaluation, we experienced a reduction in accuracy, where only 13 of 19 patients (68.4%) had been thoroughly evaluated.

By comparing our results with those published in the literature, we found that our rates either equaled or slightly exceeded the accuracy of the primary tumor stage and lymph node predictions.

In our study group, we observed that CT was performed on 53 patients, 11 before January 2012 and the remaining 42 after the advent of the multidisciplinary approach. Computed tomography provided an opportunity to assess the stage of rectal cancer either locally or remotely, with an accuracy ranging from 79 to 94%, although this dropped to 52% for the evaluation of small tumors.

Even in our study, computed tomographic evaluation did not demonstrate high sensitivity. The size of the primary tumor was evaluated correctly in 32 of the 53 cases that underwent TC, resulting in a 60.3% accuracy rate.

These results demonstrate the importance of acquiring as much information on the cancer as possible prior to surgery, and the only way to achieve this is by performing instrumental exams on the patients [7]. Notably, the methodology has changed over the years, and there is an almost clear line of demarcation between the periods before and after the end of 2011, when a thorough study of both the patient and the disease was introduced. Before our multidisciplinary approach, 32 of 45 patients were not subjected to any radiological investigation techniques. From January 2012, only 4 patients did not receive radiological examinations, one at the beginning of 2012, two in the first half of 2013, and one in the first half of 2016.

Of the remaining 13 patients under the pre-multidisciplinary approach,

- 10 executed at least one instrumental examination (7 CT and 3 endoscopic ultrasounds),
- 1 received both CT and endoscopic ultrasound,
- 2 received CT, MRI, and EUS digestive.

Meanwhile, under the multidisciplinary approach,

- 11 received at least one instrumental examination (7 CT, 3 MRI, and 1 endoscopic ultrasound)
- 33 received two tests, including 7 CT and ultrasound, 25 CT and MRI, 1 MRI and ultrasound
- 3 received CT, MRI, and EUS digestive endoscopy.

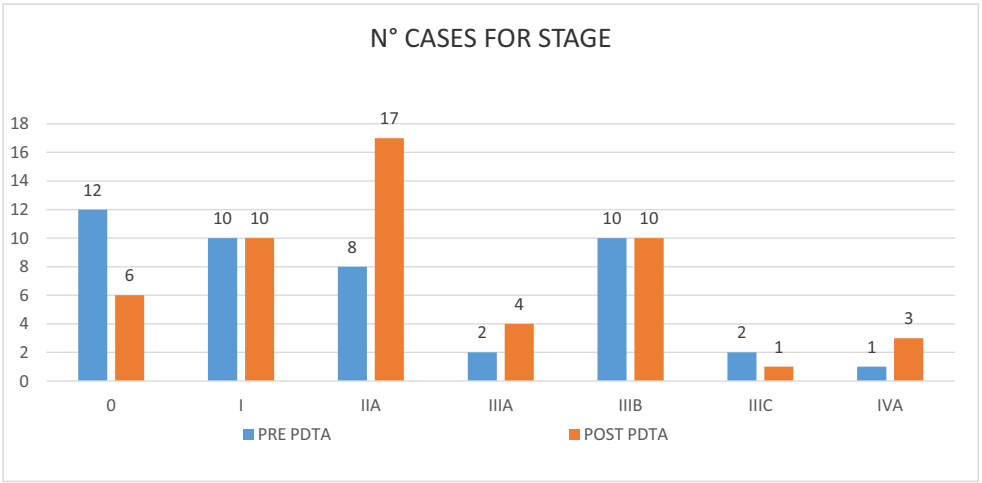

Chart 9 Number of patients divided by stage, before and after the multidisciplinary approach

The need for accurate diagnostic tests is reflected by the resected surgical specimens, showing the absence of pre-malignant lesions in 7 patients before the multidisciplinary approach, while this occurred in only 2 cases after applying the multidisciplinary route. However, we need to note that the 2 patients operated after 2012 showed benign lesions of inadequate size for an endoscopic approach (5 × 4 cm). For the 7 patients in the pre-PDTA group, the injuries did not exceed 3 × 3 cm. They could probably have been treated with a transanal endoscopic resection and non-surgical debulking. In literature it is clearly demonstrated that patients with complete response after neoadjuvant treatment have better long-term outcome than patients with little or no response [8].

In the last two decades, neoadjuvant radiotherapy with or without chemotherapy sensitizer has been increasingly used with surgical resection in the primary management of patients with rectal cancer. The rational of the therapy is based on the fact that the radiation inhibits cell proliferation, inducing cell apoptosis and impeding tumor growth.

Currently, neoadjuvant chemo-radiotherapy is suitable for adenocarcinomas T3 and T4 and for the case of lymph nodes that have cancer cells, regardless of the size of the primary tumor. Despite the many advantages offered by this technique for tumor reduction, it is important to consider that overtreatment of the patient is a potential disadvantage.

Only 10 patients in our study group received the treatment before the multidisciplinary approach, even though at least 18 of them could have been included in stages of a neoadjuvant treatment (Table 2). In contrast, for the patients operated on after January 2012, 31 of the 38 who should have received the neoadjuvant treatment did (Table 3).

Another important detail is that not all patients with stage III and above received neoadjuvant therapy, while some of them received preoperative chemo-radiotherapy treatment despite presenting a lower stage than the second, which therefore would have been overstaged (Table 2), (Table 3).

In the multidisciplinary approach, there have been cases that were not properly treated with neoadjuvant therapy

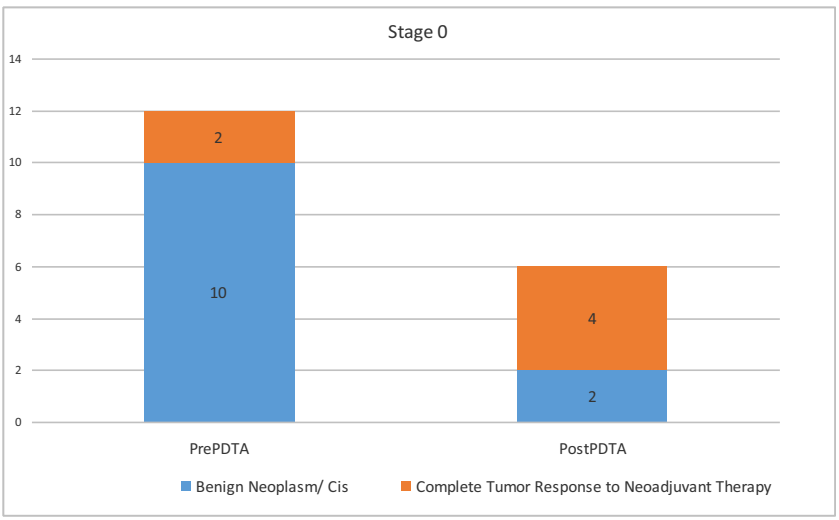

Chart 10 Patients with stage 0 which did not show malignant neoplastic disease and patients who had complete tumor response to neoadjuvant therapy, split between pre- and post-multidisciplinary approach

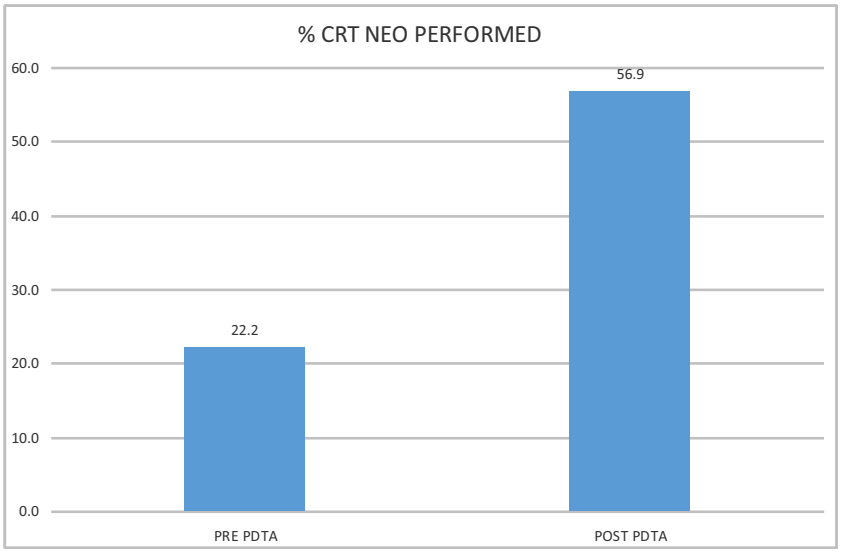

Chart 11 Percentage of patients who performed a neoadjuvant chemo-radiotherapy before and after the introduction of multidisciplinary approach. $P < 0.01$ evaluated using the chi-square test

(Table 3). Undertreatment was likely a consequence of understaging instrumental examinations.

There were 4 cases from January 2012 that did not benefit from neoadjuvant therapy due to understaging as follows:

- one case by EUS,
- one case by CT and MRI
- 2 cases by CT.

Three cases were undertreated despite indication by the imaging that the injuries were more severe than IIA; however, they underwent post-operative chemo-radiotherapy.

At present, radical resection with total mesorectal excision remains the therapeutic standard for cancer of the rectum [9]. Patients with tumors located in the proximal or intermediate portion of the rectum are frequently subjected to lower anterior resection, while the majority of patients with distal tumors in the vicinity of the anal margin require abdominoperineal amputation with permanent colostomy.

The level of the lesion and its relationship to the anal sphincter and pelvic floor are primary considerations for proper technical assessment and oncology [10]. It is also important to evaluate the initial stage of the disease, the response to neoadjuvant therapy, the histology of the tumor, and the status of the resection margins. Obese patients and those with a small pelvis can have further difficulties from a technical point of view.

All these difficulties encountered by surgeons during operations should be minimized, if not eliminated, even before the patient arrives to the operating table. This is feasible with a thorough study of each patient, taking advantage of the diagnostic and therapeutic tools at our disposal.

The role of local excision for the treatment of rectal cancer is controversial. Most surgeons reserve this type of procedure to T1 carcinomas that have particular conditions. Today, transanal endoscopic microsurgery (TEM) exploits the view offered by the binocular stereoscope (built-in operating proctoscope), which allows a perfect view during the procedure and allows the surgeon a complete excision of the mass

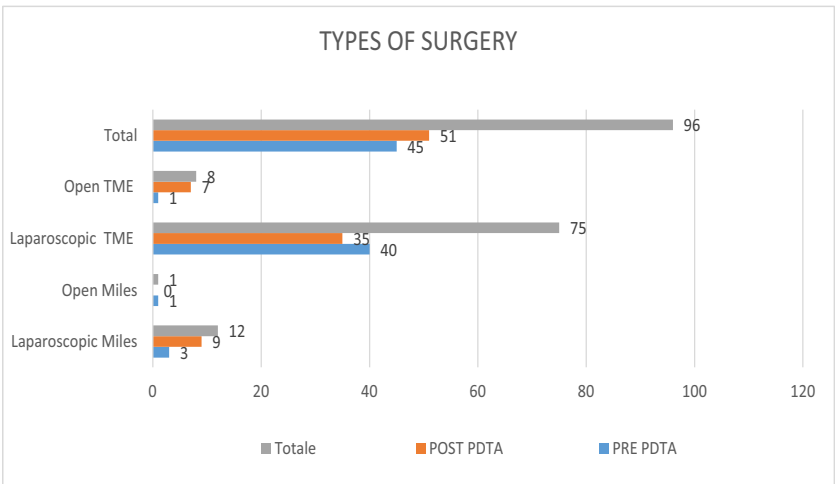

Chart 12 Number of patients divided according to the type of surgery performed in the pre- and post in PDTA

Table 2 Neoadjuvant therapy in patients operated before the multidisciplinary

Yes	10	
	Overstaged	2
	Correctly treated	8
No	35	
	Understaged	18
	Correctly treated	17

and repair of the defect in the wall of the rectum [11]. Despite the reduced morbidity and mortality, local excision is associated with a significant increase in local recurrence rate (12.5 versus 6.9% in T1 carcinomas and 22.1 against 15.1% in T2 carcinomas) [12].

Our study did not include patients treated with local excision, since TEM is still subject to discussions by the international literature, and the Sant'Anna Hospital prefers to perform radical resection.

The determining factor in choosing an operation that can save the sphincter function is the ability to obtain adequate distal resection margins. For cancers of the intermediate section and the distal segment, or in patients with anatomical difficulties, this factor can only be assessed in the operating room when the rectum is fully mobilized.

The total mesorectal excision includes excision of the entire mesorectum following the pelvic floors. The dissection should be performed accurately with the identification and preservation of the autonomic nervous system of the pelvis. The total mesorectal excision was associated with a reduction in local recurrence from 30–40% to 5–15%, suggesting that the choice of surgery has a key role in the treatment of rectal cancer [13, 14].

Concerning mininvasive surgery, many large comparative randomized trial studies have reported that there is no difference in short- and long-term outcomes between the techniques performed with laparotomy and laparoscopy in rectal cancer, even though the anterior resection with total mesorectal excision has not yet been studied in depth [15–17].

The laparoscopic rectal dissection is technically more complex and can lead to a difficult assessment of the mass with consequent resection margins affected by the tumor. However, it is important to recall how the magnified vision allows for a more correct dissection of the perirectal space and a better identification and preservation of the vital pelvic structures. Current data suggest that the laparoscopic approach can result in reduced blood loss, faster recovery of bowel function, and shorter hospitalization [18, 19]. In Europe, there is a large, multicenter study, COLOR II, which is examining the differences between laparotomy and laparoscopy [20].

Table 3 Neoadjuvant therapy in patients operated with multidisciplinary approach

Yes	31	
	Overstaged	0
	Correctly treated	31
No	20	
	Understaged	8
	Correctly treated	12

Despite the standardization and improvement of techniques, colorectal surgery is still subject to intra- and postoperative complications, which have slightly increased with the advent of laparoscopy. This is due to the technical limits imposed by laparoscopic access and the loss of three-dimensional visual and tactile sensation [21].

The most recent studies have reported an overall incidence of intraoperative accidents of 10–13% in the case of rectal surgery, which is significantly higher compared to colon surgery [22, 23]. The most frequent intraoperative complications are bleeding and intestinal, spleen, bladder, and urethral lesions.

These problems often lead to the need to convert a laparoscopic surgery to a laparotomy. Rectal colon surgery has a greater rate of conversion compared to other types of laparoscopic operations. The identified risk factors that most frequently lead to conversion are as follows [24]:

- obesity
- sex (male)
- low stages of rectal cancer
- narrow pelvis.

The conversion frequency is much higher in the rectum than in the colon (18.7 versus 9.5%, respectively).

In our study group, there were 6 conversions from laparoscopic surgery to open surgery, which only represents 7.4% of the total interventions.

It should be specified that one of these cases was a conversion from laparoscopic Miles to Miles Open, while the remaining 5 cases were interventions with front resection of the rectum with TME. The reason for conversion was not always unique. Indeed, in three cases, there were two reasons; in one case, there were three reasons that led to conversion (Table 4).

Conclusions

A multidisciplinary approach was introduced for rectal cancer just over 4 years in Emilia Romagna, with the aim of providing all the necessary information on early colorectal cancer of surgical and non-surgical patients.

The adoption of the multidisciplinary approach has revolutionized the role of the surgeon, including his role in a larger

Table 4 Evaluation of laparoscopic procedures converted to laparotomy in the total study group Arcispedale Sant'Anna di Ferrara

Adhesions	Obesity	Bleeding	Low tumor	Narrow pelvis	Lying bowel
3 cases of 8 (37.5%)	2 case of 8 (25%)	1 case of 8 (12.5%)	3 cases of 8 (37.5%)	3 cases of 8 (37.5%)	1 case of 8 (12.5%)

and more heterogeneous team, in which the various participant roles have become fundamental and essential.

Application of both the European and Italian guidelines brought a better approach to the Sant'Anna Hospital in Ferrara for treating cancer via improved staging techniques, a more precise histopathological evaluation, and more accurate multidisciplinary treatment strategies. Combined, this led the team of specialists in diagnostic, therapeutic, and nursing to a finer understanding of the natural history of rectal cancer and, consequently, to better treatment.

This result also underscores how multidisciplinary approaches are constantly improving patient selection for neoadjuvant therapy thanks to more accurate preoperative imaging techniques.

The multidisciplinary approach remains an indispensable and significant step that has improved outcomes in patients undergoing total mesorectal excision.

The objective of our study was to evaluate how the management of patients with malignant tumors of the rectum has improved with the introduction of the multidisciplinary team in Ferrara, in accordance with international and Italian guidelines that dictate the approach to the disease.

Our goal was to bring this method in line with the international standards and the results of clinical trials that have shown that the multidisciplinary approach to rectal cancer provides the best outcomes, with a 5-year disease-free survival and recurrence rates in situ.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

References

1. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, et al. Cancer Incidence and Mortality Worldwide: Sources, Methods and Major Patterns in GLOBOCAN 2012: Globocan 2012. Int J Cancer. March 1, 2015;136(5):E359–86. https://doi.org/10.1002/ijc.29210.
2. Valentini V, Aristei C, Glimelius B, Minsky BD, Beets-Tan R, Borras JM, et al. Multidisciplinary rectal cancer management: 2nd European Rectal Cancer Consensus Conference (EURECA-CC2). Radiother Oncol: J Eur Soc Ther Radiol Oncol. 92(2, August 2009):148–63. https://doi.org/10.1016/j.radonc.2009.06.027.
3. Garcia-Aguilar J, Glynne-Jones R, Schrag D. Multimodal rectal cancer treatment: in some cases, less may be more. Am Soc Clin Oncol Educ Book/ASCO Am Soc Clin Oncol Meeting. 2016;35:92–102. https://doi.org/10.14694/EDBK_159221.
4. Loria FS, Iseas S, O'Connor JM, Pairola A, Chacon M, Mendez G, et al. Non-surgical management (NSM) of rectal cancer. series of 68 cases, long follow up in two leading centres in Argentina. Digestive and Liver Disease. June 1, 2016;0(0) https://doi.org/10.1016/j.dld.2016.05.012.
5. Brown G, Radcliffe AG, Newcombe RG, Dallimore NS, Bourne MW, Williams GT. Preoperative assessment of prognostic factors in rectal cancer using high-resolution magnetic resonance imaging. Br J Surg. March 2003;90(3):355–64. https://doi.org/10.1002/bjs.4034.
6. Bipat S, Glas AS, Slors FJM, Zwinderman AH, Bossuyt PMM, Stoker J. Rectal cancer: local staging and assessment of lymph node involvement with endoluminal US, CT, and MR imaging—a meta-analysis. Radiology. September 2004;232(3):773–83. https://doi.org/10.1148/radiol.2323031368.
7. Sievers CK, Kratz JD, Zubringen LD, LoConte NK, Lubner SJ, Uboha N, et al. The multidisciplinary management of colorectal cancer: present and future paradigms. Clin Colon Rectal Surg. 2016 Sep;29(3):232–8.
8. Fiorica F, Trovò M, Anania G, Marcello D, Di Benedetto F, Marzola M, D'Acapito F, Nasti G, Berretta M. Is It Possible a Conservative Approach After Radiochemotherapy in Locally Advanced Rectal Cancer (LARC)? A Systematic Review of the Literature and Meta-analysis *J Gastrointest Cancer.* 2017. https://doi.org/10.1007/s12029-017-0041-8.
9. Broc G, Gana K, Denost Q, Quintard B. Decision-making in rectal and colorectal cancer: systematic review and qualitative analysis of surgeons. Psychol Health Med. 2017 Apr;22(4):434–48.
10. Kontovounisios C, Tan E, Pawa N, Brown G, Tait D, Cunningham D, Rasheed S, Tekkis P, "Selection process can improve the outcome in locally advanced and recurrent colorectal cancer: activity and results of a dedicated multidisciplinary colorectal cancer centre" Colorecatl dis, 2016 Sep 15.
11. Tomasone JR, Brouwers MC, Vukmirovic M, Grunfeld E, O'Brien MA, Urquhart R, Walker M, Webster F, Fitch M. "Interventions to improve care coordination between primary healthcare and oncology care providers: a systematic review" ESMO Open 2016;1:e000077. https://doi.org/10.1136/esmoopen-2016-000077.
12. You YN, Baxter NN, Stewart A, Nelson H. Is the increasing rate of local excision for stage I rectal cancer in the united states justified?: a nationwide cohort study from the National Cancer Database. Ann Surg. May 2007;245(5):726–33. https://doi.org/10.1097/01.sla.0000252590.95116.4f.
13. Heald RJ. Total mesorectal excision. The new European Gold Standard. *Il Giornale Di Chirurgia*. July 1998;19(6–7):253–5.
14. Enker WE. Total mesorectal excision—the new golden standard of surgery for rectal cancer. Ann Med. April 1997;29(2):127–33.
15. Guillou PJ, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AMH, et al. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC Trial): multicentre, randomised controlled trial. *Lancet (London, England)*. May 14, 2005;365(9472):1718–26. https://doi.org/10.1016/S0140-6736(05)66545-2.

16. Lacy AM, García-Valdecasas JC, Delgado S, Castells A, Taurá P, Piqué JM, et al. Laparoscopy-assisted colectomy versus open colectomy for treatment of non-metastatic colon cancer: a randomised trial. Lancet (London, England). June 29, 2002;359(9325):2224–9. https://doi.org/10.1016/S0140-6736(02)09290-5.
17. Veldkamp R, Kuhry E, Wim CJ, Hop J, Jeekel G, Kazemier HJB, et al. Laparoscopic surgery versus open surgery for colon cancer: short-term outcomes of a randomised trial. The Lancet Oncology. July 2005;6(7):477–84. https://doi.org/10.1016/S1470-2045(05)70221-7.
18. Staudacher C, Di Palo S, Tamburini A, Vignali A, Orsenigo E. Total mesorectal excision (TME) with laparoscopic approach: 226 consecutive cases. Surg Oncol. December 2007;16(Suppl 1):S113–6. https://doi.org/10.1016/j.suronc.2007.10.035.
14. Pugliese R, Di Lernia S, Sansonna F, Maggioni D, Ferrari GC, Magistro C, et al. Laparoscopic resection for rectal adenocarcinoma. Eur J Surg Oncol: J Eur Soc Surg Oncol Br Assoc Surg Oncol. May 2009;35(5):497–503. https://doi.org/10.1016/j.ejso.2008.10.015.
20. Bonjer HJ, Deijen CL, Abis GA, Cuesta MA, van der Pas MHGM, Klerk ESM d L-d, et al. A randomized trial of laparoscopic versus open surgery for rectal cancer. N Engl J Med. April 2, 2015;372(14):1324–32. https://doi.org/10.1056/NEJMoa1414882.
21. D'Annibale A, Morpurgo E, Fiscon V, Trevisan P, Sovernigo G, Orsini C, et al. Robotic and laparoscopic surgery for treatment of colorectal diseases. Dis *Colon rectum*. December 2004;47(12):2162–8. https://doi.org/10.1007/s10350-004-0711-z.
22. Sammour T, Kahokehr A, Srinivasa S, Bissett IP, Hill AG. Laparoscopic colorectal surgery is associated with a higher intraoperative complication rate than open surgery. Ann Surg. January 2011;253(1):35–43.
23. Guillou PJ, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AMH, et al. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC Trial): multicentre, randomised controlled trial. *Lancet (London, England)*. May 14, 2005;365(9472):1718–26. https://doi.org/10.1016/S0140-6736(05)66545-2.
24. Thorpe, H., D. G. Jayne, P. J. Guillou, P. Quirke, J. Copeland, J. M. Brown, and Medical Research Council Conventional versus Laparoscopic-Assisted Surgery In Colorectal Cancer Trial Group. "Patient factors influencing conversion from laparoscopically assisted to open surgery for colorectal cancer." *The British Journal of Surgery* 95, no. 2 (February 2008): 199–205. doi: https://doi.org/10.1002/bjs.5907.