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# Assessment of Total Mesorectal Excision through the End Pathology Report In Conventional Versus Laparoscopic Rectal Cancer Resection

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**Abstract: Background:** Colorectal cancer represents the fourth commonest malignancy worldwide. Globally, colon and rectal cancer make up 9.4% and 10.1% in men and women of all cancers, respectively. Colorectal tumor is the third most common malignancy after breast and lung cancer. The modern management of rectal cancer involves a multi-disciplinary approach and an individually tailored treatment plan. Operative surgery remains the primary and definitive treatment for locally confined rectal adenocarcinoma and is the only historical and current treatment modality which allows for cure. Resection of the colorectal cancer can be done either by local excision or laparoscopically. **Aim of the work:** The main objective is to compare the completeness of total mesorectal excision for rectal cancer in both open and laparoscopic surgery through the end pathology report. **Methods:** In this multicenter, prospective, comparative study, we included the pathologically established rectal cancer patients from 2 hospitals in Cairo, Egypt, Ain Shams University Hospitals and Maadi Military Hospital, Egypt between 2012 and 2014. The total sample size was 40 patients divided into two groups; 20 patients for laparoscopic surgery and 20 patients for the open trans-abdominal surgery. Inclusion criteria: histopathology confirmed rectal cancer, patients fit for operative resection, and with T1, T2 or T3 grades according to the preoperative assessment. The exclusion criteria: Patients with T4 stage tumor, patients present as emergency cases and patients present with recurrence of the tumor and synchronous colonic tumors. **Results:** The median size of the resected tumor was 4.00±1.98 in the laparoscopy group, while in the trans-abdominal surgery group it was 3.78±1.39. No statistical significant difference was found (p= 0.687). No statistical significant difference was found regarding the Type of the surgical operation. Total operative time was significantly shorter in the trans-abdominal surgery group, while the hospital stay period was significantly shorter in the laparoscopy group. Laparoscopy group also showed significantly time before flatus passage, and the patients in the laparoscopy group started oral intake faster than open surgery group. **Conclusion:** Long-term clinical outcomes of overall survival and recurrence is the foremost parameters which should be taken in consideration for decision for laparoscopic surgery for rectal cancer. Additional follow-up results from the current trial are presently being developed, beside with records on other secondary end points, like cost effectiveness and quality of life.

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**Keywords:** Mesorectal Excision, Conventional Versus Laparoscopic, Rectal Cancer Resection

## 1. Introduction

Worldwide, the colorectal tumors represents the 4th commonest malignancy, with diagnosing yearly of about 782,000 recent cases, in which about 401,000 in men and 381,000 in women (1, 4). Colorectal tumor are distributed nearly equally among men (9.4%) and women (10.1%) of all cancers, whereas the mortality due to colorectal cancer was averaged 394,000 deaths worldwide annually (5). In the United States (USA), almost 147,000 new cases of colorectal cancer are registered every year, of which over 40,000 were rectal. Colorectal cancer is the second commonest cancer in women in North America after breast cancer and the third most common male malignancy, after prostate and lung (5, 6). Colorectal tumor is considered the 3rd utmostcommunal malignancy after breast and lung tumor, where the colorectal cancer is being the 2nd commonest cause of tumor deaths in the UK (approximately 10%). In the United Kingdom (UK), yearly more than 37,000 recent cases diagnosed with colorectal cancer (CRC) (1-4).

Colonic and rectal cancers share an etiology and biology. The relationship between diet and the development of colorectal cancer was proposed after observations in the hugely varying rates in different countries and migrant studies. A transformation of risk

is seen over one generation, or 20 to 30 years, following migration from a low to high risk country, suggestive of environmental influences, in particular diet-modulated risk (6). Studies have suggested a decreased risk of the development of colorectal cancer in people who consume greater amounts of fruits and vegetables, with various nutrients proposed as contributing factors (10). In addition to fiber intake, meat intake has been associated with increased risk of colorectal cancer although it is not apparent whether this is related to fat, transit time or food preparation, packaging or storage (10-12). A correlation has also been proposed between increased calcium intake and a reduction of risk in colorectal cancer (13, 14). An increased risk has also been demonstrated in smokers in a dose-dependent manner, and those with excessive alcohol consumption (10, 12, 15, 16). The modern management of rectal cancer involves a multi-disciplinary approach and an individually tailored treatment plan. Operative surgery remains the primary and definitive treatment for locally confined rectal adenocarcinoma and is the only historical and current treatment modality which allows for cure. Historically and still the case today, surgery is the only treatment modality able to result in a cure for patients with rectal cancer. (17). Resection of the colorectal cancer can be done either by local excision or laparoscopically (18, 19).

In a previous study, no difference was observed in the incidence of hernia and there was no difference in recurrence rates, port-site / abdominal wall recurrence or cancer-related mortality (20). Neoadjuvant therapy is given prior to surgical procedure in order to try and improve resectability and circumferential clearance, decrease local recurrence and improve cancer-specific survival in rectal cancer(21,22).

**Aim of the work**

The main objective is to compare the completeness of total mesorectal excision for rectal cancer in both open and laparoscopic surgery through the end pathology report.

## 2. Patients and Methods

This comparative study will be done on individuals diagnosed and confirmed by histopathological examination as rectal adenocarcinoma and will be submitted for curative surgery in the department of gastrointestinal tract surgical, Ain Shams University Hospitals and Maadi Military Hospital, Egypt between 2012 and 2014. The final report will be done on the end histopathology report for the two groups. A consultant histopathologist will report all reports. All the surgical operations will be done by a consultant surgeon experienced in both surgical and laparoscopic colorectal surgery. All the patients included in the study will be informed about the procedure, either open or laparoscopic, by the operating surgeon.

Our criteria to include patients in the study was for the patients to be diagnosed with rectal cancer and confirmed with histopathology (whether had Neoadjuvant chemoradiotherapy or not), patients must be fit for operative resection, and with T1, T2 or T3 grades according to the preoperative assessment. The exclusion criteria was; Patients with T4 stage tumor, patients present as emergency cases such as (acute intestinal obstruction, perforation, and tumor invasion to adjacent organs), patients present with recurrence of the tumor and synchronous colonic tumors.

After applying the inclusion\ exclusion criteria the total sample size was 40 patients divided into two groups; 20 patients for laparoscopic surgery and 20 patients for the open trans-abdominal surgery.

As a Preoperative assessment all the included patients were admitted to a physical examination, a basic blood tests with tumor markers, colonoscopy with biopsy (rectal cancers was defined as tumors occurring up to 15 cm from the anal verge), abdomen-pelvis computed tomography, and/or Magnetic resonance imaging of the rectum.

All patients post-surgical operation were given standard care. Usually within 24–48 h of operation nasogastric tubes were removed from the patient. After confirmation of the reoccurrence of intestinal motility, oral feeding for patients can be started. Generally, within 3–6 months post-surgical operation temporary colostomy was retreated.

For the postoperative assessment the results of the two groups were compared reading the completeness of total mesorectal excision; which will be assessed in the postoperative histopathology report according to the quality of the mesorectum excised, the circumferential resection margins, the longitudinal resection margins, and the lymph node invasion (level of lymph nodes clearance).

**Surgical technique**

Normal open technique and laparoscopic approach were applied basing on skilful and experience of each surgeon. The open method was performed by mid-line incision in all open arm cases. The determination of pattern and number of laparoscopic openings depending on the opinion of the surgeon. In the open resection method, there were no mandates on the use of wound protectors, adhesion barriers or drains. By using open method and manual apparatuses and hand withdrawal, the entire pelvic dissection was carried out. Only by using laparoscopic tools below the pneumo-peritoneum in the laparoscopic resection cases, the laparoscopic resection pelvic dissection of the rectum can be done. Usually, the standard procedures of the medical

institution applied are bowel preparation, abdominal wound closure, postoperative antibiotics and venous thrombotic event prophylaxis. proximal ligation of the feeding vessels (inferior mesenteric artery and inferior mesenteric vein) must be ligated during surgical operation by the surgeons, frequently at the aorta and the inferior margin of the pancreas, respectively. The surgeons were to activate for all patients the splenic flexure of the colon and to normalize the mesenteric resection proximal to the cancer area. In the pelvis region, the level of surgical operation was recognized in the level of areolar tissue exterior the visceral fascia of the mesorectum at the plane of the sacral promontory. Depending on the surgeon favorite or the necessity of the patient, either lateral-to-medial or medial-to-lateral method was preferred to be performed. in the level outside the mesorectum the mesorectal recruitment was carried out via using of energy or sharp cutting and performed fine in the bowel underneath the place of the cancer. This cutting up permitteda right-angled transection of the mesentery and the rectum about 5 cm under the cancer mass for upper rectal tumors and low adequate to take away the whole mesorectum for mid and low rectal injuries. The piercing dissection of Waldeyer fascia, to reach the low rectum at the upper end of the anal canal due to reflection of this fascia inside the posterior surface of the mesorectum facing to the pre-sacral fascia. Distal border of the incision was estimated to be enough in case of the site of incision was below the tumor for upper rectal lesions by 5 cm length, in case of the transection was below the line of transection for middle rectal lesions by 2 cm, and the preset part of the distal border was cancer free (>1 mm) for little rectal illness. Through the behavior of the cancer during evaluation of the disease before treatment (cancer was adherent with different structures in the pelvic floor or attached with an external sphincter muscle). The necessity for resection of abdominoperineal and amputation of the sphincter with colostomy construction was taken in consideration. The predetermined plan for incision and removal of cancerous lesion from the rectum may subjected for changes according to the experience and judgment of the surgeon, for an example in case of the cancer reaction was consequently complete where an ultralow anastomosis of colonel could be performed in the distal edge with negative outcomes. Any change in the plan of transection to an abdominoperineal resection with colostomy was depending on the actual finding during the operation that proposed the probability of positive outcome in the radial edges or was done in case of the sphincter-sparing method was impossible due to many affecting factors like length of the proximal colon and blood supply and the difficulty for permitting the distal part of rectum to be anastomized. The necessity to transform to approach throughout an abdominoperineal resection should not attributed to difficulty to complete the steps of operation via the laparoscopy, in this condition the changes to open technique is measured the draw back in such conditions.

**Statistical analysis**

All data were statistically analyzed using SPSS® statistical software, version 13.0 (SPSS Inc., Chicago, IL, USA) for Windows®. A P-value was considered significant and highly significant difference at $p < 0.05$ and less than 0.01, respectively. Data were expressed as mean ± SD or number (%). For normally distributed data, quantitative variables were expressed as mean ± stander deviation (SD). Qualitative variables were expressed as percentage and frequency. Continuous variables were parallel through the Mann–Whitney U-test (non-normal distribution) or the Student's t-test (normal distribution); whereas, the Chi-square $\chi 2$-test were used for categorical variables. While, the life- table method was used for estimating overall survival rate and matched by the Gehan test.

## 3. Results

The total sample size was 40 patients, including 26 males (65%) and 14 females (35%), divided into two groups; 20 patients for laparoscopic surgery and 20 patients for the open trans-abdominal surgery. The median ager of patients in the laparoscopy group was (63.55±8.45), while the mean age in the trans-abdominal surgery group was (68.15±6.62). The baseline characteristics of the sample are showed in table (1).

**Table (1): baseline characteristics before matching.**

| **Patients demographics** | | | | | |
|---|---|---|---|---|---|
| | | **Lap** | **Open** | **$X^2$** | **P** |
| Gender | Male | 16 (80%) | 10 (50%) | 3.956 | 0.047* |
| | Female | 4 (20%) | 10 (50%) | | |
| Age (years) SD± | | (63.55±8.45) | (68.15±6.62) | -1.915 | 0.063 |
| * statistically significant difference | | | | | |

**P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value 0.01: Highly significant; NA: Not applicable**

As regarding the size of the resected tumor, the median size of the resected tumor was 4.00±1.98in the laparoscopy group, while in the trans-abdominal surgery group it was 3.78±1.39. No statistical significant difference was found (p= 0.687). No statistical significant difference was found regarding the Type of the surgical operation, histopathological findings of the biopsy, level of tumor and Pre-operative staging of the sample. The clinical characteristics and Pre-operative staging of the sample and are showed in tables (2-3) respectively.

Regarding the post-operative outcomes, the total operative time was significantly shorter in the trans-abdominal surgery group (150.50±31.70 min) comparing to the laparoscopy group (183.75±38.62 min) p value =0.005. While the hospital stay period was significantly shorter in the laparoscopy group (6.50±1.23 days) comparing to the trans-abdominal surgery group (10.70±2.41 days) with p value <0.001. Laparoscopy group also showed significantly time before flatus passage (2.65±0.75 days) comparing to the trans-abdominal surgery group (4.70±1.26 days) with a p value <0.001. The patients in the laparoscopy group started oral intake after (3.40±0.82 days) comparing to (5.00±1.86 days) in the trans-abdominal surgery group with a significant p value <0.001. The post-operative outcomes, operative details and post-operative staging of the sample are showed in tables (4-5-6) respectively.

**Table (2): clinical characteristics before matching**

| | | Lap | Open | $X^2$ | P |
|---|---|---|---|---|---|
| **Type of planned surgical operation** | Ant. Resect. | 15 (75%) | 11 (55%) | 1.758 | 0.185 |
| | APR | 5 (25%) | 9 (45%) | | |
| **Biopsy** | Adeno | 12 (60%) | 12 (60%) | 2.818 | 0.421 |
| | Inf. Adeno | 3 (15%) | 1 (5%) | | |
| | Poor Adeno | 4 (20%) | 7 (35%) | | |
| | Villous dysplasia | 1 (5%) | 0 (0%) | | |
| **Neoadj.** | No | 11 (55%) | 10 (50%) | 0.100 | 0.752 |
| | Yes | 9 (45%) | 10 (50%) | | |
| **Level of tumor (cm)** | | 9.37±3.65 | 8.15±3.63 | 1.063 | 0.295 |
| **Tumor size (cm)** | | 4.00±1.98 | 3.78±1.39 | 0.406 | 0.687 |

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value 0.01: Highly significant; NA: Not applicable

**Table (3): Pre-operative staging of the sample.**

| | | Lap | Open | $X^2$ | P |
|---|---|---|---|---|---|
| **Pre-operative staging according to MRI Report** | T1N0Mx | 1 (5%) | 0 (0%) | 13.692 | 0.622 |
| | T2N0Mx | 5 (25%) | 8 (40%) | | |
| | T2N1M0 | 1 (5%) | 0 (0%) | | |
| | T2N1Mx | 1 (5%) | 1 (5%) | | |
| | T2N2Mx | 1 (5%) | 0 (0%) | | |
| | T3N0Mx | 1 (5%) | 2 (10%) | | |
| | T3N1M1 | 0 (0%) | 1 (5%) | | |
| | T3N1Mx | 6 (30%) | 4 (20%) | | |
| | T3N2M0 | 1 (5%) | 0 (0%) | | |
| | T3N2M1 | 1 (5%) | 1 (5%) | | |
| | T3N2Mx | 1 (5%) | 1 (5%) | | |
| | T3N3Mx | 0 (0%) | 1 (5%) | | |
| | T3NxM0 | 1 (5%) | 0 (0%) | | |
| | T4N2Mx | 0 (0%) | 1 (5%) | | |

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value 0.01: Highly significant; NA: Not applicable

**Table (4): post-operative outcomes of the sample.**

| | Lap | Open | T | P |
|---|---|---|---|---|
| **Operative Time (minutes) mean, SD** | 183.75±38.62 | 150.50±31.70 | 2.976 | 0.005** |
| **Hospital Stay (days) mean, SD** | 6.50±1.23 | 10.70±2.41 | -6.939 | <0.001** |
| **Flatus (days) mean, SD** | 2.65±0.75 | 4.70±1.26 | -6.260 | <0.001** |
| **Oral intake (days) mean, SD** | 3.40±0.82 | 5.00±1.86 | -3.514 | <0.001** |
| **, High statistically significant difference | | | | |

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value 0.01: Highly significant; NA: Not applicable

**Table (5): Operative details of the sample.**

| | | Lap | Open | $X^2$ | P |
|---|---|---|---|---|---|
| **Quality of Total Mesorectal Excision** | Complete | 16 (80%) | 17 (85%) | 0.173 | 0.677 |
| | Incomplete | 4 (20%) | 3 (15%) | | |
| **LN Location and number harvested** | No | 2 (10%) | 6 (30%) | 8.615 | 0.125 |
| | Mesorectal | 17 (85%) | 10 (50%) | | |
| | Sup rectal | 1 (5%) | 1 (5%) | | |
| | Internal iliac | 0 (0%) | 1 (5%) | | |
| | Pelvic wall | 0 (0%) | 2 (10%) | | |
| **CRM (mm) mean, (SD)** | | 3.38±1.16 | 1.50±0.45 | 3.207 | 0.003** |
| **LRM (cm ) mean, (SD)** | | 5.50±1.98 | 5.20±2.28 | 0.349 | 0.729 |
| **CRM less than 1mm** | | 2 (10%) | 4 (20%) | - | - |
| **CRM more than or equal to 1mm** | | 18 (90%) | 16 (80%) | - | - |

**, High statistically significant difference

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value 0.01: Highly significant; NA: Not applicable

**Table (6): post-operative staging of the sample**

| **Post-operative TNM and pathology staging** | | | | | |
|---|---|---|---|---|---|
| | | **Lap** | **Open** | $X^2$ | **P** |
| **TNM Staging** | T0N0M0 | 1 (5%) | 0 (0%) | 13.333 | 0.577 |
| | T0N0Mx | 1 (5%) | 1 (5%) | | |
| | T1N0Mx | 1 (5%) | 0 (0%) | | |
| | T2N0Mx | 7 (35%) | 5 (25%) | | |
| | T2N1Mx | 1 (5%) | 1 (5%) | | |
| | T2N5Mx | 0 (0%) | 1 (5%) | | |
| | T3N0Mx | 3 (15%) | 6 (30%) | | |
| | T3N1Mx | 3 (15%) | 1 (5%) | | |
| | T3N2Mx | 2 (10%) | 1 (5%) | | |
| | T3NxMx | 0 (0%) | 1 (5%) | | |
| | T4N1Mx | 0 (0%) | 1 (5%) | | |
| | T4N2Mx | 1 (5%) | 1 (5%) | | |
| | TxN1Mx | 0 (0%) | 1 (5%) | | |
| **Post-operative pathology staging** | Stage 0 | 2 (10%) | 1 (5%) | 1.278 | 0.735 |
| | Stage Ⅰ | 4 (20%) | 14 (20%) | | |
| | Stage Ⅱ | 5 (25%) | 8 (40%) | | |
| | Stage Ⅲ | 9 (45%) | 7 (35%) | | |

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value 0.01: Highly significant; NA: Not applicable

## 4. Discussion

In this multicenter, prospective, comparative study, we included the pathologically established rectal cancer patients from 2 hospitals in Cairo, Egypt. After reviewing the literature, we found many studies that compared laparoscopic surgery with open surgery in rectal cancer patients and found no significant difference between the two techniques regarding safety and survival of the patients, on the other hand they found the laparoscopic surgery to have some advantages over open surgery regarding the morbidity (23-26). In our study we followed a strict criteria while choosing the surgeons and pathologists eligible to conduct the assessment. Thus the overall successful rate of surgery in the present study was about 85%. The rate of post-operative mortality and complications was low.

In previous studies, the UKCLASICC colorectal cancer trials reported a 12% positive rate of CMR by using the laparoscopic approach, whereas it averaged 6% by applying open incision (23,27). Another study conducted in Australia on 475 patients, reported the rate of CMR involved in laparoscopic surgery to be 6.7% compared to 3% in the open surgery group (28). Another European trail conducted on 1044 patients reported for CRM participation rate of 10% with <2-

mm margin and with a rate of 90% complete total mesorectal excision (29). A study conducted in South Korea compared between the open and laparoscopic surgery in rectal cancer patients reported a minimum rate of CRM involvement (3%), although the rate of complete mesorectal excision was 73% in contrast with 85% in the present study (30). In our study the rate of CMR less than 1 cm in the laparoscopic group was 10% while it was 20% in the open surgery group.

In the present study, the laparoscopy group was associated with significantly longer time of operation comparing to the open surgery group (183.75±38.62 vs. 150.50±31.70 p=0.005). A previous systematic review reported similar results when comparing the laparoscopic approach to open surgery in the treatment of rectal cancer, where the laparoscopy group was associated with longer operative time (210.8 ± 88.9 min vs 173.5 ± 72.7 min, P = 0.028) (31). Another study reported similar results where it reported the operation time in the laparoscopic approach to be 40 minutes longer than the open surgery approach (32). The difference in operation time between the two approaches can be explained by the difference in experience between surgeons and the difficulty of the operation regarding the position of the tumor.

Hospitalization time is considered to be an important indicator of the operation success, patient rehabilitation. In our study we reported a high statistically significantly shorter hospital stay time associated with the laparoscopic approach (6.50±1.23) comparing to the open surgery (10.70±2.41) p<0.001. Previous studies reported similar results regarding the hospital stay time, where the laparoscopic approach was associated with significantly shorter hospitalization time (33-36). Many factors affect the hospitalization time like the preexisting medical conditions such as severe cardiovascular disease and severe respiratory disease, the condition of the patient, the tumor stage and its position in the rectum.

Regarding the post-operative recovery time, it can be measured using many clinical variables like the time to pass flatus and the time to start oral intake after the surgery. Regarding the time to pass flatus, it was significantly shorter in the laparoscopy group (2.65±0.75 days) comparing to (4.70±1.26 days) in the open surgery group p<0.001. many previous study reported similar findings where the laparoscopic approach was associated with shorter time to pass flatus (31,32). On the other hand many other studies reported no significant difference between the two approaches regarding the time to pass flatus (37-39).

Regarding the before first oral intake, it was significantly shorter in the laparoscopy group comparing to the open surgery group (3.40±0.82 vs. 5.00±1.86 p<0.001). Many other studies reported similar results (31-34).

Our study has many limitations, such as the lack of randomization. The quality of the laparoscopy devices and the experience of the surgeons are considered very important points that can affect the outcomes of the surgery. Our study has a relatively small sample size which may affect the generalizability of our results.

**Conclusion**

Long-term clinical outcomes of recurrence and overall survival is the essential parameters must be taken in consideration for deciding rectal cancer excision by using laparoscopic surgery. More follow-up information from the current trial are presently required, beside with findings on other secondary end points, like cost effectiveness and quality of life.

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