



ROYAUME DU MAROC  
UNIVERSITE MOHAMMED V DE  
RABAT  
FACULTE DE MEDECINE  
ET DE PHARMACIE  
RABAT



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# SHORT-TERM RESULTS OF LAPAROSCOPY VERSUS LAPAROTOMY FOR RECTAL CANCER SURGERY : A RETROSPECTIVE STUDY

## THESIS

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**BY**

**Mrs. Soundouss SEBBATA**

*Born on June 27th, 1996 in Rabat*

*Intern Doctor of Univeristy Hospital Center Rabat*

*FOR THE DEGREE OF*

## Doctor of Medicine

**Key Words:** Rectal neoplasms; Laparoscopy; Morbidity

### **Jury Members:**

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أَتُوا الْعِلْمَ دَرَجَاتٍ

سورة المجادلة - الآية 11

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*KHALED Abdellah*

*Chef du Service des Affaires Administratives*

*FMPR*

*\*Enseignant militaire*



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# *Dedications*

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*Chef du service de chirurgie viscérale I*

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# *Illustrations*

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## Figures

<b>Figure 1:</b> Comparison of operative time in different trials .....	41
<b>Figure 2:</b> Comparison of Blood Loss in different studies between laparoscopy and laparotomy .....	42
<b>Figure 3:</b> Comparison of Hospital stay between laparoscopy and laparotomy (days)	43
<b>Figure 4:</b> Comparison of Anastomotic Leakage between laparoscopy and laparotomy in different trials .....	44
<b>Figure 5:</b> Comparison of the readmission rate between laparoscopy and laparotomy	46
<b>Figure 6:</b> Comparison of reoperation rate between laparoscopy and laparotomy .....	46
<b>Figure 7:</b> Comparison of negative CRM in different trials .....	48

## Tables

<b>Table 1:</b> comparison of patients' characteristics between laparoscopy and laparotomy .....	16
<b>Table 2:</b> tumor location .....	17
<b>Table 3:</b> Tumor differentiation and TNM classification .....	18
<b>Table 4:</b> Surgical procedure and associated resections.....	19
<b>Table 5:</b> comparison in items of the textbook outcome between laparoscopy and laparotomy .....	20
<b>Table 6:</b> Per-Operative outcomes.....	21
<b>Table 7:</b> post operative complications .....	23
<b>Table 8:</b> post operative outcomes ( mortality, severe complications, readmission and reoperation rate) .....	24
<b>Table 9:</b> Quality of resection in laparotomy and laparoscopy groups .....	25
<b>Table 10:</b> characteristics of patients who did not benefit from associated resections .	27
<b>Table 11:</b> tumor location and neoadjuvant therapy for patients who hadnt benefited from associated resection.....	28
<b>Table 12:</b> tumor differentiation and TNM classification for patients who didn't benefit from associated resection.....	29
<b>Table 13:</b> Surgical procedure for patients who didn't benefit from associated resection .....	30
<b>Table 14:</b> comparison in items of the textbook outcome between laparoscopy and laparotomy for patients who didn't benefit from associated resection .....	31
<b>Table 15:</b> per-operative outcomes for patients who didn't benefit from associated resection .....	32

**Table 16:** post operative complications for patients who didn't benefit from associated resection..... 33

**Table 17:** post operative outcomes for patients who didn't benefit from associated resections..... 34

**Table 18:** Quality of resection for patients who did not benefit from associated resection ..... 35



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# *Table of contents*

---



<b>I. Introduction</b> .....	2
<b>II. Methods</b> .....	8
1- Type of study and context .....	8
2- Eligibility criteria .....	8
3- Variables collected .....	9
a- Preoperative variables .....	9
b- Per operative variables .....	10
c- Postoperative variables.....	11
4- Definition of outcomes.....	11
a- Primary outcome .....	11
b- Secondary outcomes .....	11
5- Data collection.....	12
6- Statistical analysis .....	13
<b>III. Results</b> .....	15
Part 1: All patients .....	15
1. Patients’ characteristics .....	15
2. Disease characteristics.....	17
3. Surgical procedure.....	19
4. Main outcome.....	20
5. Secondary outcomes.....	21
a- Per-operative.....	21
b- Post-operative outcomes.....	22

c - Quality of resection.....	25
Part 2: analysis after exclusion of extended resections .....	26
1- Patient’s characteristics.....	26
2- Disease’s characteristics .....	28
3- Surgical procedure .....	30
4- Main outcome .....	30
5- Secondary outcomes .....	32
a- Per operative .....	32
b- Post operative .....	33
c- Quality of resection:.....	35
<b>IV. Discussion .....</b>	<b>37</b>
1- Summary of results.....	37
2- Discussion of the results and comparison with the literature.....	38
a- Main outcome: Textbook outcome .....	40
b- Secondary outcomes .....	41
3- Strengths of the study.....	49
4- Weaknesses of the study .....	50
5- Perspectives and recommendations.....	51
<b>V. Conclusion.....</b>	<b>53</b>
<b>Abstract.....</b>	<b>54</b>
<b>Annexe.....</b>	<b>58</b>
<b>References .....</b>	<b>62</b>



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# *Introduction*

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## **I. Introduction**

Colorectal cancer is the second most common cause of cancer-related death worldwide. The World Health Organization (WHO) estimates the number of new cases worldwide at 732 210, and the number of deaths at 339 022 per year [1]. In Morocco, Rectal Cancer is considered the 10th most common cancer, with a 5-year prevalence of 12.3/10 000, making it one of the most dreaded cancers. Even though the incidence and death of colorectal cancer are on the decline in the USA and Europe, there is a general trend toward an increase in rectal cancer's incidence within people under 50 years-old [2]. No similar data has been reported in Morocco until today.

Management of rectal cancer is evolving. The ideal treatment is multidisciplinary, requiring both surgical and medical interventions [3]. Taking the patient's preferences, tumor characteristics, and functional outcomes into consideration is primordial. The surgical procedure discussed here is only a piece of the total treatment required for rectal cancer patients to receive the best care possible.

For the management of rectal cancer, the treatment strategy depends on where the tumor is located, the distance between cancer's distal extension and the anal verge, as well as cancer's proximity to the anal sphincter, which should normally be evaluated as part of a thorough physical examination and objectively determined by Magnetic Resonance Imaging (MRI) [4]. The histological diagnosis of adenocarcinoma is established first, prior to elective treatment. Also, patients should undergo a thorough colonic evaluation. Before starting the treatment, rectal cancer must be staged using the American Joint Committee on Cancer TNM method [5]. Except in cases where urgent surgery is

required [2]. Pelvic MRI is the preferred locoregional clinical staging. When deciding between early T stages or when MRI is not appropriate, endorectal ultrasonography may be used [5]. Patients with rectal cancer should routinely undergo clinical staging for metastatic disease. It is systematically decided in a multidisciplinary consultation meeting (RCP), after the referring surgeon has examined the patient, to assess the different adequate surgical techniques. The patient's operability and his or her wish to avoid a possible mutilating surgery should also be taken into consideration [6].

Laparotomy has always been the method of choice for colorectal cancer surgery. Laparoscopy was only introduced in 1991 as an alternative to laparotomy and became widely practiced throughout the world. Several randomized trials have been reported [7]–[9]. Laparoscopic colectomy in colon cancer surgery has demonstrated its effectiveness in large-scale randomized controlled trials. With comparable oncologic results to the open procedure, patients could now benefit from the minimally invasive method since it has proven to be superior to laparotomy in terms of short-term and long-term results [10], [11]. The NCCN Guidelines recommendations have explicitly stated that laparoscopic surgery in colon cancer can be considered the standard method for treatment [12].

However, laparoscopy in rectal cancer is not the reference surgery but is considered as an alternative to conventional laparotomy after 7 randomized trials [7]–[9], [13]–[16]. These trials tend to prove the non-inferiority of laparoscopy compared to open surgery. Their purpose was to show that laparoscopy's efficacy is not less than the approved standard surgery method. (Noninferiority trials, an alternative to equivalence trials, aim to show that a novel treatment is neither better nor worse than the standard [17]).

Two of the randomized trials (ACOSOG Z6051 [14], [18] and ALACART [18]) failed to prove the non-inferiority of laparoscopy compared to open surgery. The following randomized trials; COLOR II, CLASICC, and the COREAN trials all showed non-inferior results of laparoscopy compared to open surgery [7], [9], [13]. Whilst Meta-analyses only looked at short-term results [19], [20].

Short-term results included per-operative and postoperative outcomes. The duration of surgery was significantly higher for laparoscopy among all trials conducted. The blood transfusion needs were not different between the laparoscopy and laparotomy groups in the CLASICC trial [7]. In the COLOR II trial [9], less blood was lost during laparoscopic surgery.. The same results were found in the ALACART trial [18].

Concerning postoperative outcomes, in line with Arezzo[19] and the meta-analysis conducted by our department [21], laparoscopy patients required a shorter hospital stay. Comparable results were found in the CLASICC trial where the laparoscopy group's hospital stay was 2 days shorter [7].

Most studies assessed morbidity according to the the Clavien- Dindo tool [22]. The Australian [18], Korean [13], and American [8] trials carried out this categorization and found that patients undergoing laparotomies and laparoscopies experienced similar severe complications. The COLOR II trial [9] demonstrated that In terms of surgical morbidity and safety of resection, the laparoscopic approach was able to generate outcomes that were comparable to those of open surgery.

Regarding the quality of resection, a qualified pathologist examines the specimen macroscopically and microscopically to assess the resection's quality. Quirke and colleagues [23] have underlined the importance of the circumferential resection margin (CRM) over the years as a major prognostic factor for rectal cancer. Between the laparotomy and open surgery group, no statistically significant difference was found among the seven randomized trials conducted. In the ALACART trial, CRM was positive for 3% of patients in the open surgery group compared to 6.7% in the laparoscopy group (p 0.06). This previous result joins those of the CLASICC study.

All the afro-mentioned trials used several individual outcomes to compare laparoscopy and laparotomy. Recently, a different approach has been introduced to surgery by Kolfshoten et Al. in 2013 [24] when they proposed this new measure summarizing outcomes indicators called the “Textbook outcome” (TO). He investigated in a colon cancer study led in Netherlands, the percentage of patients for whom all desired short-term outcomes after treatment were achieved, including the absence of mortality, reintervention, complications, readmissions, and achievement of R0 resections. This textbook outcome measures the percentage of patients who have perfect composite postoperative results, avoiding a single indicator-driven approach [25]. Since its first publication, the TO has been applied to oeso-gastric cancer surgery, rectal cancer surgery, liver transplantation and cardiovascular surgery. However, it has never been used to compare laparoscopic to open surgery specifically.

The place of laparoscopy is not clear-cut, we still need studies to emphasize its place in rectal surgery. There have been no comparative studies in countries with Low- and Mid-Income comparing the two techniques. It is in this context

that we propose here in a low- and Mid-Income country (Morocco) to provide additional answers on the place of laparoscopy in rectal cancer.

The aim of this study is to compare short-term outcomes between laparoscopy and laparotomy for rectal cancer resections, focusing on the “textbook outcome” as a main primary outcome.



# *Methods*



## **II. Methods**

### **1- Type of study and context**

This study was conducted at the Surgical Oncology Department of the National Institute of Oncology in Rabat, Morocco. It is a retrospective single center study using a prospective database of rectal cancer surgeries, comparing short-term outcomes between laparoscopy and laparotomy for the surgical treatment of rectal adenocarcinoma.

The Surgical Oncology Department is dedicated to the surgical treatment of digestive tumors, mainly colorectal and liver cancers. More than one hundred colorectal resections are performed in the department. The implementation of laparoscopy was initiated in 2018. Rectal cancer surgeries before this date were performed exclusively by open surgery.

Two senior surgeons performed all laparoscopic surgeries. Both surgeons had basic laparoscopic courses and training during their residency. After residency, they both participated in several advanced courses in laparoscopic colorectal surgery and worked for at least five years in high load colorectal surgery departments (> 50 cases per year). In 2018, both surgeons started laparoscopic rectal cancer without supervision and developed their individual learning curve. All open rectal resections were performed by three senior surgeons (including the two surgeons mentioned above).

### **2- Eligibility criteria**

Were included in this study all consecutive patients aged more than 16 years-old, who received a curative intent resection for primary rectal adenocarcinoma between January 1st, 2018 and December 31st, 2021.

Patients who had emergency resection or had transanal resection or resection for locally recurrent rectal adenocarcinoma were not included. No patient was excluded from this study.

An initial comparative analysis was performed. Then, a secondary analysis was performed after excluding patients with associated local or distant resections.

The choice between laparoscopic and laparotomy was made by the surgeon. **Surgeries converted from laparoscopy to laparotomy were included in the laparoscopic group on an intention-to-treat basis.**

### **3- Variables collected**

#### **a- Preoperative variables**

Age, sex, body mass index (BMI), WHO Performance status score, past history of abdominal surgery, undernutrition, comorbidities, and American society of anesthesiologists (ASA) grade were among data that was prospectively documented.

##### *➤ WHO Performance status score*

The patient's performance status (PPS) is a trustworthy predictor of their overall health. It is a crucial prognostic factor in clinical practice and a helpful tool in survival prediction and treatment decision models [26]. In this study, we used the WHO performance status score which remains subjective and based on the rater's judgment and experience. It is a score ranking from zero to five (Annexe)

➤ *Nutritional status*

In contemporary surgical practice, nutrition risk assessment and classification are increasingly crucial to ensuring the best outcomes [27]. Undernutrition was defined by the presence of: weight loss > 10% or albumin < 30 g/l or body mass index < 18 kg/m<sup>2</sup>.

➤ *ASA score*

Using the American society of anesthesiologists score, we rated patients according to their physiological status to estimate the operative risk. (Annexe)

➤ *Comorbidities*

Understanding the complexity of the patient's history and comorbidities is essential for optimizing surgical outcomes, thus were included diabetes, cardiac stroke, cerebral stroke, anticoagulant treatment, and hemoglobin rate that was assessed to be >10g/dl or < 10g/dl.

➤ *Tumor location*

The subclassification of the 15 cm of the rectum into equal thirds based on its distance from the anal margin— high (>10 cm), intermediate (6–10 cms), and low (5 cm) rectums—determined the tumor's location.

**b- Per operative variables**

Details of the surgical procedures included type of resection (total mesorectal excision, partial mesorectal excision or abdomino-perineal resection) and type of reconstruction. Duration of surgery and blood loss were collected.

### **c- Postoperative variables**

The following details about surgical specimen analysis were collected: tumor staging according to the TNM grading system, distal margin and circumferential margin, number of harvested lymph nodes.

Postoperative complications were assessed at 90 days following surgery. They were graded according to the Clavien-Dindo system.

## **4- Definition of outcomes**

### **a- Primary outcome**

The main aim of this study was to compare the textbook outcome between laparoscopy and laparotomy. If each of the following criteria was satisfied, the textbook outcome was achieved:

- No 90 days mortality
- No 90 days reintervention
- No 90 days complications > Clavien-Dindo grade II
- No 90 days readmission
- R0 resection.

R0 resection was retained if the circumferential margin was > 1 mm, AND distal margin was free AND no tumor perforation.

### **b- Secondary outcomes**

The secondary objective was to compare individual short-term outcomes between the two techniques, mainly morbidity and the quality of resection:

- **Mortality rate:** at 90 days-delay after the intervention.

- **The length of hospital stay:** counting from the surgical date until the patient leaves the hospital.
- **Anastomotic leakage:** Several definitions have been proposed for anastomotic leakage, based on the patient's clinic and confirmed by further investigations or by surgical exploration of the fistula during the operation. According to the International Study Group of Rectal Cancer (ISREC), which has given a consensus definition of anastomotic fistula, it can be divided into three classes (A, B, and C) [28]. (Annexe)
- **Reoperation rate:** counting any operation proceeded within 90 days after surgery.
- **Readmission rate:** any readmission of the patient in the hospital for any reason within 90 days
- **Estimated Blood loss:** volume of blood lost during surgery or number of blood pouches that were transfused during or after surgery

## 5- Data collection

Data was retrieved from the department's prospective rectal cancer surgery database. Study data were collected and managed using REDCap electronic data capture tools hosted by l'Institut de Recherche sur le cancer (Fes, Morocco).[29], [30] REDCap (Research Electronic Data Capture) is a secure, web-based software that supports data capture for research projects.

Data was double checked by two different researchers, by comparing it to source documents within the electronic medical records (physicians and nurses notes, surgical reports, pathology reports, consultation reports, imaging and biology tests reports...).

## **6- Statistical analysis**

For the Statistical analysis we used Jamovi 3rd generation statistical spreadsheet. The Jamovi project (2022). *jamovi* (Version 2.3) [Computer Software]. Retrieved from <https://www.jamovi.org>

Quantitative data was expressed as mean with standard deviation or median with quartiles depending on the population's distribution. Qualitative data was expressed as a percentage number.

For the comparison between the two techniques, the Student or Mann-Whitney "t" test was used for quantitative data and the Chi-2 or Fischer tests for qualitative data, as appropriate. Statistical significance was accepted if p values were less than 0.05.



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## *Results*

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### **III. Results**

#### **Part 1: All patients**

##### **1. Patients' characteristics**

The number of patients with rectal adenocarcinoma who underwent surgery between January 2018 and December 2021 was 258. Laparoscopy was performed for 162 patients and laparotomy for 96 patients. Among the 162 patients in the laparoscopy group, 14.8% (n=24) had intraoperative conversion to open surgery.

The median age was 54 years for laparotomy and 57 years for laparoscopy, with a male predominance in the laparoscopy group compared to laparotomy (54.3% vs. 41.7 %.  $p = 0.049$ ). There were no statistically significant differences in the nutritional status (BMI and undernutrition), Performance status, ASA score and co-morbidities. There were significantly more active smokers in the laparoscopy group (9.3% vs. 2.1%.  $p=0,025$ ).

**Table 1:** comparison of patients' characteristics between laparoscopy and laparotomy

		Laparotomy (n=96)	Laparoscopy (n=162)	P
Age ( mean)		54.6 +- 14.6	57.1 +- 11.3	0.109
Sex no- (%)	male	40 (41.7%)	88 (54.3%)	<b>0.049</b>
	female	56 (58.3%)	74 (45.7%)	
BMI mean (kg/m <sup>2</sup> )		22.9 +- 5.6	23.2 +- 3.6	0.595
OMS score no- (%)				
	0 – 1	87 (90.6%)	156 (96.3%)	0.060
	>1	9 (9.4%)	6 (3.7%)	
ASA score no- (%)				
	ASA 1	76 (79.2%)	121 (74.7%)	0.567
	ASA 2	20 (20.8%)	40 (24.7%)	
	ASA 3	0 (0%)	1 (0.6%)	
Nutritious Grade no- (%)				
	GN2	83 (86.5%)	140 (86.4%)	0.852
	GN4	11 (11.5%)	20 (12.3%)	
	Missing	2 (2.1%)	2 (1.2%)	
Comorbidities no- (%)				
Smoking		2 (2.1%)	15 (9.3%)	<b>0.025</b>
Cerebral stroke		0 (0%)	4 (2.5%)	0.121
Cardiac stroke		0 (0%)	3 (1.9%)	0.180
Diabetes		8 (8.3%)	21 (13.0%)	0.255
Anticoagulant treatment		1 (1.0%)	5 (3.1%)	0.292
Hemoglobin rate (g/dl) no- (%)				
>10		88 (91.7%)	148 (92.5%)	0.810
<10		8 (8.3%)	12 (7.5%)	

## 2. Disease characteristics

Lower rectal tumors were the most common among our patients, whether they underwent laparoscopic surgery 44.4% or laparotomy 58.1%, compared to 33.8% and 29.0% patients respectively with middle rectal cancer. Only 21.9% in laparoscopy and 12.9% in laparotomy had a high rectum tumor. There was no statistically significant difference between the two groups. P 0.075

**Table 2:** tumor location

		Laparotomy (n=96)	Laparoscopy (n=162)	P
<i>Tumor site ( distance from the anal margin)</i>				
<i>no- (%)</i>	<b>&lt; 5 cms</b>	<b>54 (58.1%)</b>	<b>71 (44.4%)</b>	<b>0.075</b>
	<b>6 – 10 cms</b>	<b>27 (29.0%)</b>	<b>54 (33.8%)</b>	
	<b>&gt;10 cms</b>	<b>12 (12.9%)</b>	<b>35 (21.9%)</b>	
<i>Neoadjuvant treatment</i>		<b>79 (82.3%)</b>	<b>117 (72.2%)</b>	<b>0.067</b>

The tumors included were all adenocarcinomas, with medium to well-differentiated tumors accounting for 91.5% in the laparoscopic group and 89.4% in the second group (p= 0.593).

Laparoscopy and open surgery did not differ regarding the TNM classification. There was no statistically significant difference in primary tumors classified as pT0 to pT3 (91.4% in laparoscopy and 85.4% in open surgery, p = 0.138).

Concerning clinical lymph nodes, there were also no statistically significant differences between the two groups. Metastasis were higher in the laparotomy group than in the laparoscopy group with a statistically significant difference (12.3% vs. 21.9%.  $p=0.043$ ).

**Table 3:** Tumor differentiation and TNM classification

		Laparotomy (n=96)	Laparoscopy (n=162)	P
<i>Tumor differentiation</i>				
	<b>Medium-well differentiation</b>	76 (89.4%)	140 (91.5%)	<b>0.593</b>
	<b>Low-mucinous differentiation</b>	9 (10.6%)	13 (8.5%)	
<i>pTa staging</i>				
<i>p T0 – T3</i>		82 (85.4%)	148 (91.4%)	<b>0.138</b>
<i>p T4</i>		14 (14.6%)	14 (8.6%)	
<i>pNa staging</i>				
<i>N0</i>		61 (63.5%)	100 (61.7%)	<b>0.771</b>
<i>N+</i>		35 (36.5%)	62 (38.3%)	
<i>pMa staging</i>				
<i>M0</i>		75 (78.1%)	142 (87.7%)	<b><u>0.043</u></b>
<i>M+</i>		21 (21.9%)	20 (12.3%)	

### 3. Surgical procedure

There was no difference in the type of surgical resection between the two groups. The rate of local and distal associated resections was, however, significantly higher in the laparotomy group. Associated resection was performed for 41.7% of patients in the laparotomy group compared to only 16.0% in the laparoscopy group ( $p < 0.001$ ).

**Table 4:** Surgical procedure and associated resections

	Laparotomy (n=96)	Laparoscopy (n=162)	P
<i>Surgical procedure</i>			
<b>TME</b>	41 (42.7%)	57 (35.2%)	<b>0.229</b>
<b>PME</b>	17 (17.7%)	43 (26.5%)	
<b>AAP</b>	38 (39.6%)	62 (38.3%)	
<i>Associated resection</i>	40 (41.7%)	26 (16.0%)	<b>&lt;0.001</b>

#### 4. Main outcome

We found that within the laparoscopy group, 53.1% of patients reached textbook outcome. Compared to only 39.6% in the laparotomy group. With a significant statistical difference p 0.036.

There were no statistically significant differences in each item of the “textbook outcome” between the two groups counting reoperation and readmission rate, severe complications, mortality or radicality.

**Table 5:** comparison in items of the textbook outcome between laparoscopy and laparotomy

Outcome	Laparotomy	Laparoscopy	p
Textbook outcome	39.6%	53.1%	0.036
90 days no mortality	94.8%	97.5%	0.246
90 days no reintervention	87.5%	87.0%	0.914
90 days complications ( $\leq 2$ Clavien-Dindo score)	76.0%	80.9%	0.357
90 days NO readmission	85.4%	88.9%	0.663
R0 resection	72.9%	79.0%	0.263

## 5. Secondary outcomes

### a- Per-operative

- ❖ *Operative time* : Laparoscopic resection required a longer surgical procedure than open surgery (mean, 294.0 vs 262.0 minutes; mean difference, 32 minutes; P.001).
- ❖ *The contamination rate during surgery* : was higher in the laparotomy group than in the laparoscopic one (14.6% vs 8.6%; P 0.13)
- ❖ *Blood loss* : The laparoscopic group tended to get fewer blood transfusions (2.5% versus 3.1%; P 0.60)

**Table 6:** Per-Operative outcomes

	<b>Laparotomy (n=96)</b>	<b>Laparoscopy (n=162)</b>	<b>P</b>
<b>Operating room time</b>	262.0 +- 74.1	294 +- 75.7	<b>0.001</b>
<b>Contamination</b>	14 (14.6%)	14 (8.6%)	0.138
<b>Transfusion</b>	8 (8.3%)	12 (7.4%)	0.411

### **b- Post-operative outcomes**

- ❖ *The duration of hospital stay* was found to be the same in both groups (10 days, P 0.42)
- ❖ Counting complications during the hospital stay, cardiopulmonary dysfunction, and infection rate were not significantly different between the two groups. Abdominal collections were higher in the open surgery group compared to laparoscopy but with no statistically significant difference (11.5% vs 8.6% P 0.46)
- ❖ *Anastomotic leakage* : Patients who underwent anastomosis counted for 56.8% (n= 92) in laparoscopy and 55.2% (n=53) in laparotomy. Anastomotic leakage was higher in the open surgery group than in the laparoscopic group but with no statistically significant difference (18.5% versus 24.5% P 0.38).

**Table 7:** post operative complications

	Laparotomy (n=96)	Laparoscopy (n=162)	P
<b>Hospital stay (days/ median) (u-mann..)</b>	10 [ 7 – 17]	10 [ 6 – 14]	0.42
<b>Complications</b>			
<b>Infectious complications</b>	15 (15.6%)	21 (13.0%)	0.551
<b>Pulmonary complications</b>	1 (1.0%)	5 (3.1%)	0.292
<b>Cardiac complications</b>	2 (2.1%)	2 (1.2%)	0.594
<b>Abdominal collection</b>	11 (11.5%)	14 (8.6%)	0.46
<b>Anastomosis</b>	53 (55.2%)	92 (56.8%)	0.804
<b>Anastomotic leakage</b>	13/92 (24.5%)	17/53 (18.5%)	0.386
<b>Grade A</b>	5 (38.5%)	4 (23.5%)	0.644
<b>Grade B</b>	3 (23.1%)	4 (23.5%)	
<b>Grade C</b>	5 (38.5%)	9 (52.9%)	
*Anastomotic leakage was counted only for patients who benefited from anastomosis			

❖ *Severe complications: There was no statistically significant difference regarding severe complications.*

A maximum Clavien score during the hospital stay equal or below 2 was higher in the laparoscopy group (84.6 % vs 82.3 % P 0.632) but not statistically significant

A maximum Clavien score equal to or below 2 in the 90-day follow-up was also higher in the laparoscopy group (80.9 % vs 76.0% P 0.357).

**Table 8:** post operative outcomes ( mortality, severe complications, readmission and reoperation rate)

	Laparotomy (n=96)	Laparoscopy (n=162)	P
Clavien score during hospital stay			
=< 2	79 (82.3%)	137 (84.6%)	0.632
> 2	17 (17.1%)	25 (15.4%)	
Clavien score 90 days follow up			
=< 2	73 (76.0%)	131 (80.9%)	0.357
> 2	23 (24.0%)	31 (19.1%)	
Reoperation rate	12 ( 12.5%)	21 (13.0%)	0.914
Readmission rate	13 (13.5%)	16 (9.9%)	0.663
Mortality	5 (5.2%)	4 (2.5%)	0.246

### C - Quality of resection

- ❖ *Negative CRM* : there was no statistical significant difference between the two groups, with a negative CRM at 79.0% in laparoscopy and 74.0% in laparotomy.
- ❖ *Distal clearance* was not significantly different for both groups. Positive distal margin was higher in the laparoscopic group compared to the open surgery group (1.2%, 2.1% p =0.586)

The two groups did not significantly differ in terms of the quality of the resected specimens, regarding positive distal and circumferential margin rates.

**Table 9:** Quality of resection in laparotomy and laparoscopy groups

	<b>Laparotomy (n=96)</b>	<b>Laparoscopy (n=162)</b>	<b>P</b>
Distal margin negative	93 (97.9%)	160 (98.8%)	0.586
Circumferential margin			
CRM>1mm (negative)	71 (74.0%)	128 (79.0%)	0.350
Perforation	13 (13.5%)	14 (8.6%)	0.350
Radicality			
R0	70 (72.9%)	128 (79.0%)	0.335
R1	26 (27.1%)	33 (20.4%)	
R2	0	1 (0.6%)	

## **Part 2: analysis after exclusion of extended resections**

For an objective analysis of data and to reduce selection bias, an analysis of the previous data excluding patients who underwent associated resection was performed.

### **1- Patient's characteristics**

The total patient number was 192. 136 patients underwent laparoscopy and 56 laparotomy.

With a mean age of 57.5 years and 56.4 years, respectively in laparoscopy and laparotomy, with a male predominance in both groups (58.8%, 51.8% p 0.371).

There were no statistically significant differences in the nutritional status (BMI and undernutrition), Performance status, ASA score and co-morbidities. In the laparoscopic group compared to the open surgery group, the percentage of active smokers remained higher. (1.8% - 11.0% P 0.035)

**Table 10:** characteristics of patients who did not benefit from associated resections

		Laparotomy (n=56)	Laparoscopy (n=136)	P
Age (mean)		56.4 +- 11.1	57.5 +- 12.7	0.560
Sex no- (%)	male	29 (51.8%)	80 (58.8%)	0.371
	female	27 (48.2%)	56 (41.2%)	
BMI mean (kg/m <sup>2</sup> ) mean		23.3 +-6.4	23.3 +-3.5	0.922
OMS score no- (%)				
	0 – 1	50 (89.3%)	130 (95.6%)	0.101
	>1	6 (10.7%)	6 (4.4%)	
ASA score no- (%)				
	ASA 1	44 (78.6%)	100 (73.5%)	0.463
	ASA 2	12 (21.4%)	36 ( 26.5%)	
	ASA 3	0	0	
Nutritious Grade no- (%)				
	GN2	47 (87.0%)	120 (88.9%)	0.720
	GN4	7 (13.0%)	15 (11.1%)	
Comorbidities no- (%)				
Smoking		1 (1.8%)	15 (11.0%)	<b>0.035</b>
Cerebral stroke		0	4 (2.9%)	0.195
Cardiac stroke		0	3 (2.2%)	0.263
Diabetes		7 (12.5%)	20 (14.7%)	0.689
Anticoagulant treatment		1 (1.8%)	4 (2.9%)	0.648
Hemoglobin rate (g/dl) no- (%)				
>10		52 (92.9%)	129 (95.6%)	0.446
<10		4 (7.1%)	6 (4.4%)	

## 2- Disease's characteristics

Lower rectal tumors were predominant in laparoscopic (42.5%) and in laparotomy patients (57.1%), followed by middle rectal cancer (34.3% vs 26.8%) and high rectal tumors (23.1% vs 16.1%).

There was no statistically significant difference in the proportion of patients in the two groups who benefited from preoperative treatment (82.1% vs 69.9%. p 0.08 ).

**Table 11:** tumor location and neoadjuvant therapy for patients who hadnt benefited from associated resection

		Laparotomy (n=56)	Laparoscopy (n=136)	P
Tumor site ( distance from the anal margin)				
no- (%)	< 5 cms	32 (57.1%)	57 (42.5%)	0.180
	6 – 10 cms	15 (26.8%)	46 (34.3%)	
	>10 cms	9 (16.1%)	31 (23.1%)	
Neoadjuvant treatment		46 (82.1%)	95 (69.9%)	0.080

Regarding TNM classification, primary tumors classified as pT0 to pT3 showed no statistically significant difference between the two groups (96.3% vs. 91.1% . p = 0.137).

The proportion of patients with clinical lymph nodes was similar in the two groups. There was no statistically significant difference in the percentage of clinical metastasis (19.6% vs 11.0%. p 0.112) .

**Table 12:** tumor differentiation and TNM classification for patients who didn't benefit from associated resection

		Laparotomy (n=56)	Laparoscopy (n=136)	P
Tumor differentiation				
	Medium-well differentiation	47 (92.2%)	120 (91.6%)	0.903
	Low–mucinous differentiation	4 (7.8%)	11 (8.4%)	
pTa staging				
p T0 – T3		51 (91.1%)	131 (96.3%)	0.137
p T4		5 (8.9%)	5 (3.7%)	
pNa staging				
N0		37 (66.1%)	84 (61.8%)	0.574
N+		19 (33.9%)	52 (38.2%)	
pMa staging				
M0		45 (80.4%)	121 (89.0%)	0.113
M+		11 (19.6%)	15 (11.0%)	

### 3- Surgical procedure

There was no difference in the type of surgical resection between the two groups.

**Table 13:** Surgical procedure for patients who didn't benefit from associated resection

		Laparotomy (n=96)	Laparoscopy (n=162)	P
<i>Surgical procedure</i>				
	<i>TME</i>	23 (41.1%)	49 (36.0%)	0.251
	<i>PME</i>	10 (17.9%)	40 (29.4%)	
	<i>AAP</i>	23 (41.1%)	47 (34.6%)	

## Outcomes

### 4- Main outcome

We found that There was no statistically significant difference in the percentage of textbook outcome reached for each group. We count within the laparoscopy group, 55.1% patients and 46.4% in the laparotomy group.

There was no statistically significant difference between the two groups regarding each item, counting reoperation and readmission rate, severe complications, mortality or radicality.

**Table 14:** comparison in items of the textbook outcome between laparoscopy and laparotomy for patients who didn't benefit from associated resection

<b>Outcome</b>	<b>Laparotomy</b>	<b>Laparoscopy</b>	<b>p</b>
Textbook outcome	46.4%	55.1%	0.271
90 days no mortality	98.2%	97.8%	0.853
90 days no reintervention	86.8%	91.1%	0.404
90 days complications ( $\leq 2$ Clavien-Dindo score)	82.1%	80.1%	0.750
90 days NO readmission	50 (89.3%)	121 (89.0%)	0.923
R0 resection	76.8%	82.4%	0.374

## 5- Secondary outcomes

### a- Per operative

- ❖ *operative time*: Laparoscopic resection required a longer surgical procedure than open surgery (mean, 285.0 vs 242.0 minutes; mean difference, 44 minutes; P.001).
- ❖ *The contamination rate during surgery*: was higher in the laparotomy group than in the laparoscopy group (14.3% vs 5.1%; P 0.032)
- ❖ *Blood loss*: The laparoscopic group tended to get fewer blood transfusions (6.6% versus 7.1%; P 0.60)

**Table 15:** per-operative outcomes for patients who didn't benefit from associated resection

	Laparotomy (n=56)	Laparoscopy (n=136)	P
operating room time (mins) mean	242 +- 63.9	285 +- 70.4	<0.001
Contamination	8 (14.3%)	7 (5.1%)	0.032
Transfusion	4 (7.1%)	9 (6.6%)	0.895

### b- Post operative

- ❖ *The duration of hospital stay* was nearly the same for both groups (10.5 days, P 0.31).
- ❖ The postoperative complications regarding cardiopulmonary dysfunction and infection rate were lower in the laparoscopic group than in the open surgery group. but not statistically significant
- ❖ *Anastomotic leakage*: patients who underwent anastomosis counted for 60.3% in laparoscopy and 53.6% in laparotomy. Among these patients, anastomotic leakage was non-significantly higher in the open surgery group than in the laparoscopic group (23.3% (n=7) versus 18.3% (n=15).

**Table 16:** post operative complications for patients who didn't benefit from associated resection

	Laparotomy (n=56)	Laparoscopy (n=136)	P
Hospital stay (days/ median)	10.5 [6.75 – 17.3]	10.0 [6.0 – 14.0]	0.311
Complications			
Infectious complications	6 (10.7%)	19 (14.0%)	0.542
Pulmonary complications	0	5 (3.7%)	0.146
Cardiac complications	1 (1.8%)	2 (1.5%)	0.873
Abdominal collection	8 (14.3%)	11 (8.1%)	0.191
Anastomotic leakage	7/30 (23.3%)	15/82(18.3%)	0.552
Grade A	2 (28.6%)	3 (20.0%)	0.366
Grade B	3 (42.9%)	3 (20.0%)	
Grade C	2 (28.6%)	9 (60.0%)	
*Anastomotic leakage was counted only for patients who benefited from anastomosis			

❖ *Severe complications:* A maximum Clavien score during the hospital above 2 was higher in the laparotomy group compared to the laparoscopic group (17.9% vs 16.2 % P 0.22). A maximum Clavien score above 2 in the 90-day follow-up was reached by more patients in the laparoscopic group than in open surgery (19.9% vs 17.9% P 0.088)

**Table 17:** post operative outcomes for patients who didn't benefit from associated resections

	<b>Laparotomy (n=56)</b>	<b>Laparoscopy (n=136)</b>	<b>P</b>
Clavien score during hospital stay			
=< 2	46 (82.1%)	114 (82.8%)	0.776
> 2	10 (17.9%)	22 (16.2%)	
Clavien score 90 days follow up			
=< 2	46 (82.1%)	109 (80.1%)	0.750
> 2	10 (17.9%)	27 (19.9%)	

**c- Quality of resection:**

- \* *Negative CRM:* A positive lateral margin was reported in 19.6% of open-surgery patients and 17.6% of laparoscopy patients with no statistically significant difference p 0.745.
- \* *Distal clearance* was not statistically different between the two groups, 0.7% had a positive distal clearance in the laparoscopic group compared to 3.6% in the second group, p 0.144.

**Table 18:** Quality of resection for patients who did not benefit from associated resection

	<b>Laparotomy (n=56)</b>	<b>Laparoscopy (n=136)</b>	<b>P</b>
Distal margin negative	53 (96.4%)	135 (99.3%)	0.144
Circumferential margin			
CRM>1mm	45 (80.4%)	112 (82.4%)	0.745
Perforation	8 (14.3%)	10 (7.4%)	0.134



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## *Discussion*

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## **IV. Discussion**

### **1- Summary of results**

This study compared the results of laparoscopy and laparotomy in the oncological surgery department for patients who underwent surgery for rectal adenocarcinoma between January 2018 and December 2021.

Analysis of each parameter of this study separately showed that the population in the two groups differed in terms of gender, smoking, and TNM stratification.

There was a selection bias in the percentage of associated resections, which was higher in the laparotomy group. Concerning the per-operative outcomes, operative time was longer in the laparoscopy group. Hospital stay, complications using the Clavien-Dindo score, and readmission did not show any significant differences between the two groups. Textbook outcome achievement rate was statistically higher in the laparoscopy group.

For an objective analysis of the data and to reduce selection bias, an analysis of the previous data excluding patients who underwent associated resection was performed. With the exception of smoking rate, which was higher in the laparoscopy group, there were no significant differences between the two groups' characteristics.

For the per-operative outcomes, and as expected, laparoscopic surgery was associated with significantly higher operating time (242 +- 63.9 versus 285 +- 70.4min;  $P < 0.001$ ), less per-operative transfusion (6.6% versus 7.1%;  $P = 0.002$ ).

No statistically significant differences were found postoperative complications during the hospital stay or during the 90-day follow-up using the Clavien-Dindo score. Also, no differences were found concerning reoperation and readmission rates. Anastomotic leakage was not significantly higher in laparotomy. As for Mortality during the 90-day follow-up, our study showed no significant difference neither. The quality of resection did not statistically differ between the two groups, including negative circumferential margin and distal clearance. Finally, the rate of Textbook outcome was not different between the two groups.

## **2- Discussion of the results and comparison with the literature**

Studies conducted in Morocco concerning the management of colorectal cancer are not numerous. Even less, those dealing with laparoscopy. We may report the last cohort prospective study [31] conducted in 4 surgery centers in Morocco whose objective was to audit the results of laparoscopic colon cancer surgery in our country and its outcomes. This study concluded that Laparoscopy is only performed by a small number of surgeons, thus there was a tight patient selection process, but also compared to open surgery, it was linked to less-effective resections.

We are unaware of any published research assessing laparoscopic surgery for rectal cancer in Low- and Mid-Income Countries (LMIC). In order to examine the status and outcomes of laparoscopic rectal cancer surgery in Morocco, we are reporting the first LMIC national monocentric study comparing the conventional and the laparoscopic technique in rectal cancer.

Given the complexity of operating inside the pelvis, the improvements in perioperative outcomes of these minimally invasive treatments are particularly significant.

The literature includes several findings comparing laparoscopic to open surgery in rectal cancer in randomized studies and meta-analyses of prospective and retrospective trials.

We would mention seven randomized controlled trials (RCT) ([7]–[9], [13], [16], [18], [32]) that emphasized the oncologic outcomes of this procedure and that came out with conflicting conclusions from one another. Laparoscopic resection did not meet the criteria for non-inferiority when compared to open resection, according to the RCT carried out by Fleshman in America (ACOSOG Z6051) [14]. The Australian RCT led by Stevenson et Al. reached the same conclusions [18]. These two studies denied laparoscopic surgery's non-inferiority in cases of rectal cancer because of worries about appropriate oncologic resection. Despite the release of these studies, the prevalence of laparoscopic use has continued to increase.

Kang et Al. in his RCT published in 2010 [13] found that, laparoscopic approach for advanced rectal cancers after neoadjuvant treatment was non-inferior to the laparotomy technique in terms of short and long-time outcomes.

According to long-term follow-up data from the CLASICC study [7], laparoscopic treatment for rectal cancer had the same long-term local and distant recurrence rates as open surgery. The RCT conducted by Van der Pas [9] in the Netherlands showed that laparoscopic resection led by well-trained surgeons had comparable oncological results to the open surgery approach, short term outcomes were in favor of laparoscopy as long-term follow-up has not been studied yet.

According to these reports, we understand that laparoscopic surgery for rectal cancer may be a safe approach, but the oncological safety has not yet been proven.

Failure to prove the non-inferiority of laparoscopy compared to open surgery following the ACOSOG Z6051 [14] and ALACART [18] trials doesn't imply a demarginalization of the place of laparoscopy in rectal surgery. Therefore, this technique cannot yet be the standard care in such pathology.

These results lead to the overall conclusion that laparoscopic resection of rectal cancer is safe and practical, although the oncologic efficacy has not yet been proven..

Our study compared the oncological outcomes of laparoscopy and laparotomy in terms of textbook outcome, morbidity; per-operative outcomes, postoperative outcomes, and quality of resection. Our findings were consistent with those that have been reported worldwide in randomized and non randomized trials.

#### **a- Main outcome: Textbook outcome**

We found that among all our patients, the textbook outcome was more achieved in the laparoscopy group than in the laparotomy group. The difference between the two groups was no longer significant when patients with associated resection were excluded. No other international study has specifically compared this parameter between the two rectal surgery techniques.

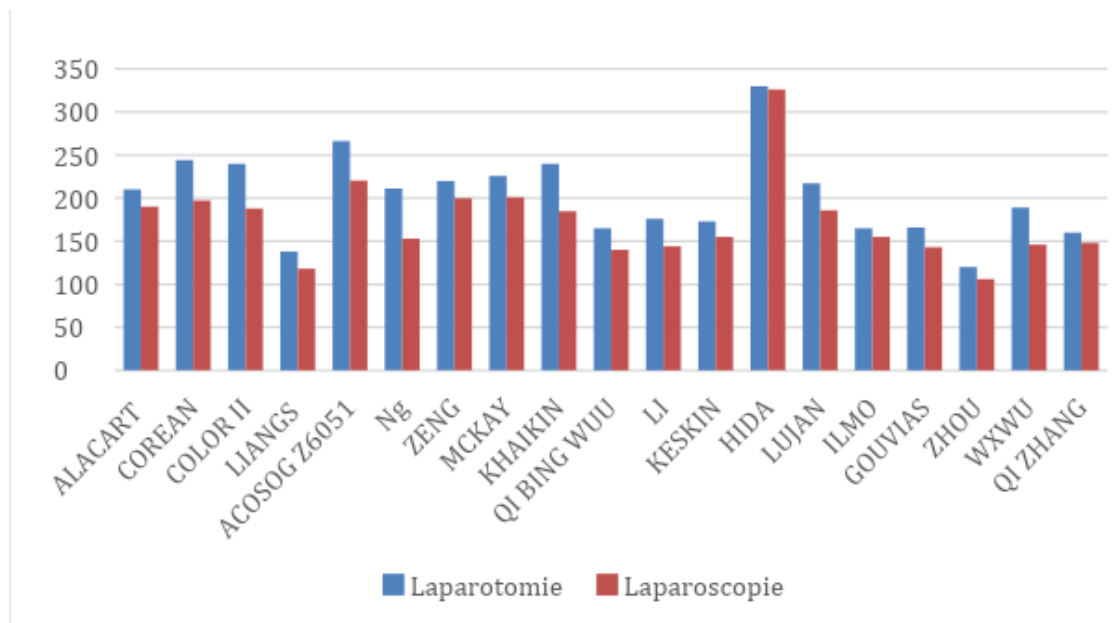
In the recent multicenter study conducted by Warps in the Netherlands, the rate of textbook outcome TO was 59.2% in the laparoscopy group compared to 43.4% in the laparotomy group. [39] this data suggests that textbook outcome could be achieved more frequently in laparoscopy than in laparotomy.

## b- Secondary outcomes

### ➤ *Per-operative outcomes*

#### ❖ **Duration of surgery**

Operative time matched the findings of the literature. And as expected, laparoscopy required more time compared to the conventional technique. Enhancing recovery after laparoscopic colorectal surgery is significantly affected by the time of the operation [33]. Thus, Laparoscopy remains a challenging technique which will therefore involve a prolonged operating time, it is a time-consuming surgery. In literature, whether in randomized studies or not, the same results were found [7], [9], [13], [18], [32], [34].



**Figure 1:** Comparison of operative time in different trials

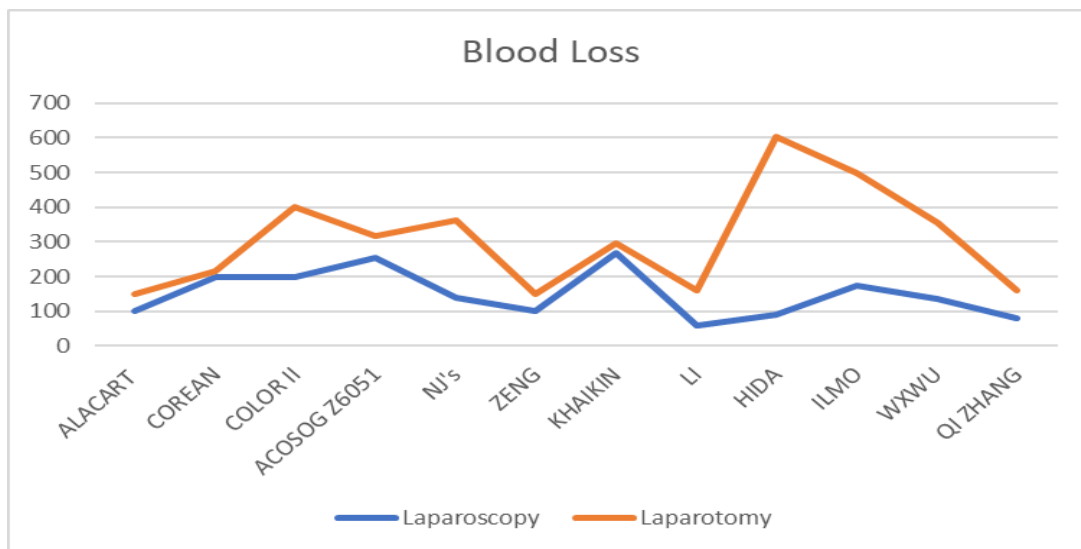
## ❖ Transfusion And Blood Loss

In the treatment of colorectal cancer, surgery makes sure that there is maximum exposure of the pelvic cavity with a direct view of the tumor to be resected as well as identification of the pelvic vessels which allows immediate hemostasis in case of blood loss. Nevertheless, per operative bleeding is not neglected [35].

In our study, blood loss was higher in the open surgery group than in the laparoscopy group. This was consistent with the results of the COREAN trial [13]; (median 217.5 mL [150.0–400.0] vs 200.0 mL [100.0–300.0],  $p=0.006$ ). Similar results were found in the COLOR II trial [9].

As for the real-life studies, HIDA et al. [36] also found that blood loss was significantly higher in the open surgery group (90 vs 625 mL,  $P < 0.001$ ).

The meta-analysis conducted by our department [21] showed that blood loss was statistically higher in the laparotomy group: Mean difference was -70.62 ml [-88.84, -52.40] with CI 95% ( $P < 0.00001$ ).



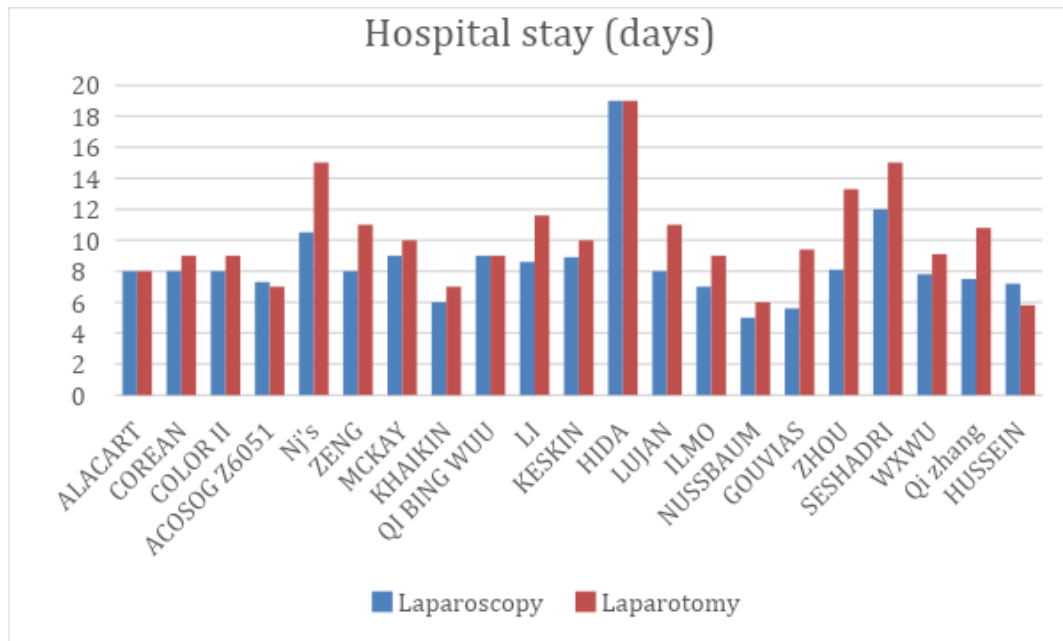
**Figure 2:** Comparison of Blood Loss in different studies between laparoscopy and laparotomy

➤ *Post-operative outcomes*

❖ *Length of hospital stay*

In our series, the duration of hospitalisation was lower for patients who underwent laparoscopic surgery. The average hospital stay duration varied significantly between groups. The COLOR II [9] showed that after laparoscopic surgeries, the median hospital stay was one day less than after laparotomy. Other real-life studies [36]–[40] had the same findings.

In a meta-analysis published in 2021 [21], it mentioned that the laparoscopy group had a shorter hospital stay, although this difference was not statistically significant: -0.29 days on average [-0.72, 0] .13] CI 95% (P = 0.18).



**Figure 3:** Comparison of Hospital stay between laparoscopy and laparotomy (days)

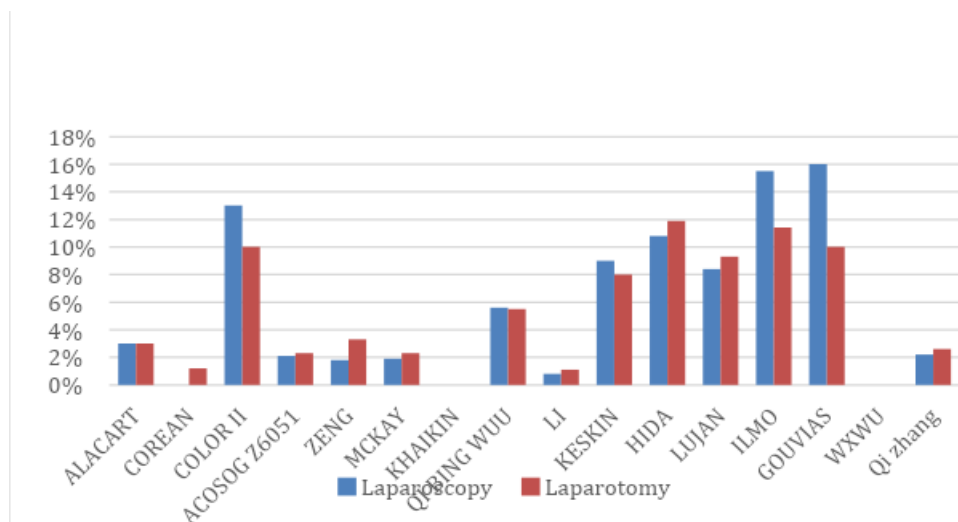
### ❖ Anastomotic leakage

Another significant issue in rectal surgery is anastomotic leakage (AL), which can result in postoperative intraperitoneal infections [41]. It is considered as a serious complication that may result in higher morbidity and mortality and may even be considered as the most serious complication after colorectal cancer surgery [42].

In the literature, the prevalence of AL after colorectal surgery varies between 2% and 19%. It has also been shown that mortality-related fistula between 0.8% and 27% [41].

We noted in our study that the rate of anastomotic leakage was non-significantly higher in the open surgery group.

Only a few studies [38], [43], [44] found anastomotic leakage to be higher in laparoscopy groups than in open surgery groups as mentioned in the COLOR II [9] and CLASICC [7] trials. The ALACART [18] trial found no significant difference between the two groups.



**Figure 4:** Comparison of Anastomotic Leakage between laparoscopy and laparotomy in different trials

### ❖ **Abdominal collection**

In our study there was a slight increase in the rate of abdominal collections within the open surgery group compared to laparoscopy with no statistically significant difference. These findings join the results of the COLOR II [9] and COREAN [13] trials.

### ❖ **Severe complications**

We used the Clavien-Dindo classification to assess severe complications during hospital stay and within the 90-days follow up delay. We observed that the laparotomy group was more likely to experience a maximal Clavien-Dindo score equal to or above 2 than the laparoscopic group but with no statistically significant difference.

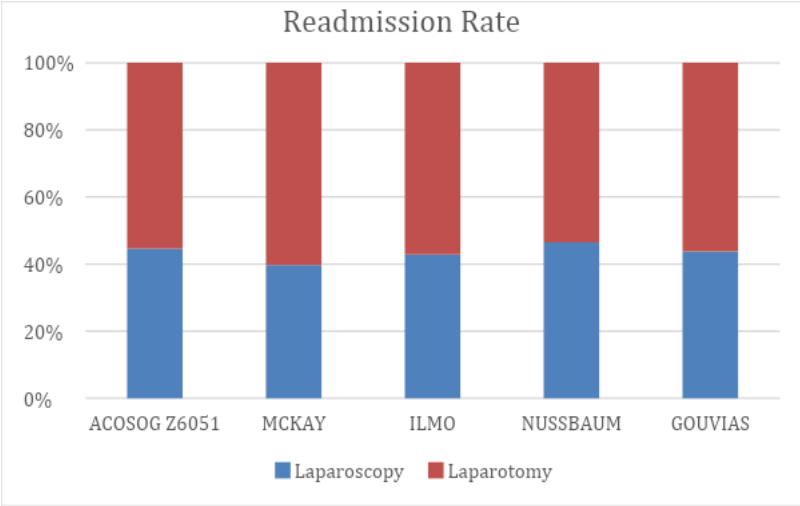
Due to the fact that it assigns a weighting based on the degree of intervention required for a particular issue, the Clavien-Dindo grading system may be effective in assessing the burden of complications [45]. This classification was used by the American [8], Australian [18] and the Korean [13] randomized trials. They showed that severe complications were similar for laparotomy and laparoscopy patients.

In other non-randomized studies, complications were monitored without using the previous system, in LIANG's trial [34], for example, similar complications rates were observed for both groups.

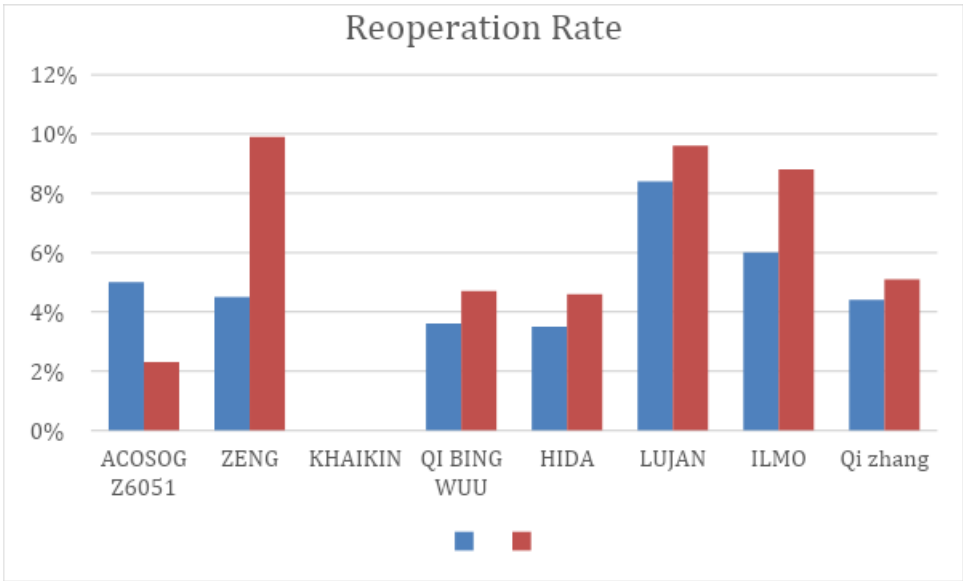
### ❖ **Readmission and reoperation rates**

The reoperation rate in our study was not statistically different between open surgery and laparoscopy joining the results of the ACOSOG Z6051 trial [14]. In the ZENG study [46], the reoperation rate was (4.5% -9.9%) but the difference was not statistically significant.

The readmission rate was higher for open surgery but with no statistical difference in ACOSOG Z6051 (4.1% - 3.3% p 0.81) and MCKAY [45] (14.6- 9.6% p 0.09 ) studies.



**Figure 5:** Comparison of the readmission rate between laparoscopy and laparotomy



**Figure 6:** Comparison of reoperation rate between laparoscopy and laparotomy

➤ *Quality of resection*

According to Quirke et al. [23], failure to achieve a local complete clearance of tumor after surgery is a primary factor in the local recurrence of rectal adenocarcinoma. It has historically been underestimated and is mostly brought on by lateral tumor dissemination [47]. Suture implantation of tumor cells from the lumen or nearby lymphatics, and the development of a metachronous anastomotic tumor are all potential reasons. Nevertheless, the root cause is still unknown, particularly in patients who have had curative resections.

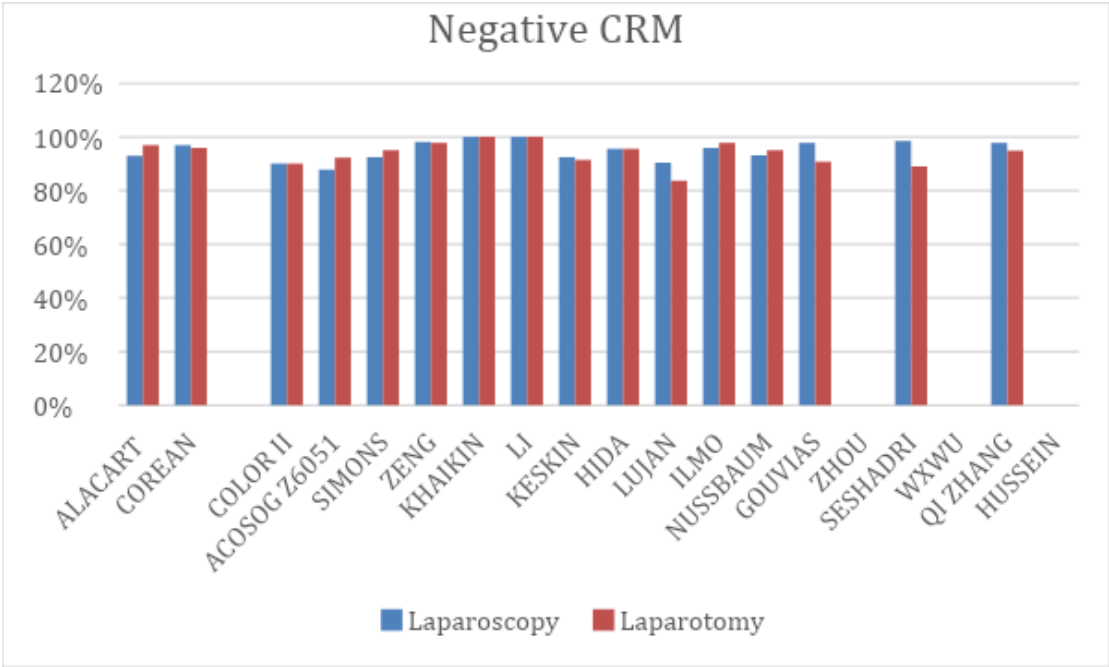
These studies make the quality of the rectal specimen relevant. Especially when comparing two surgical techniques. Assessment of this parameter may be standardized by evaluating the circumferential margin (CRM) and the distal margin and quality of the mesorectum.

Low CRM positivity and good macroscopic quality of TME tissues were the most important prognostic markers in rectal cancer surgery, which were revealed by pathological investigation [13]. CRM is considered positive when the distance between the outermost of the tumor and the radial margin is  $\leq 1\text{mm}$  [23], [47]. We did not consider in our study the mesorectal excision quality as an indicator of a successful or poor-quality surgery.

When it comes to positive circumferential resection margins (CRM) $\leq 1\text{mm}$ , our study showed no statistically significant difference between laparoscopy and laparotomy. As much as it did not show any significant difference concerning distal clearance.

A recent meta-analysis [20] showed no statistically significant difference between the two groups in terms of positive CRM. Same results were found in the meta-analysis conducted in our surgical department where no statistically significant difference was found between the laparoscopy and the open surgery group [21].

Some of the real-life studies [43], [44], [48] were not in contradiction with these results.



**Figure 7:** Comparison of negative CRM in different trials

### 3- Strengths of the study

The study we carried out in the Digestive Oncology Surgery Department of the National Institute of Oncology in Rabat was to assess the short-term outcomes of the laparoscopy compared to laparotomy in rectal cancer.

- The Department of Digestive Surgical Oncology in Rabat performs more than sixty rectal resections performed per year. This number is higher than any threshold proposed in the literature to define a high-volume center. Laparoscopy rate for rectal cancer was higher than laparotomy in the department, even though laparoscopy was introduced recently. In addition, the equivalent results between the two approaches show that the learning curve was quickly achieved and did not have an impact on the results of the comparison. Therefore, we can conclude that the implementation of laparoscopy was quick and safe in the department.
- This study is one of the rare studies performed in Morocco, and in a low-mid income country in general, comparing laparoscopy to laparotomy for rectal resections. It would give additional evidence on the place of laparoscopic surgery for rectal cancer, and particularly in our country and in similar contexts.
- To our knowledge, this is the first study to use “textbook outcome” as a criterion for comparison. All previous studies used individual outcomes for comparison. TO is a composite outcome that includes postoperative morbidity and mortality and the quality of resection.

- All postoperative outcomes were evaluated at 90 days after surgery. Most previously published studies evaluated complications 30 days after surgery.
- The availability of a prospective database dedicated to rectal cancer surgery has enabled the collection of reliable and easily exploitable accurate informations. In addition, two independent researchers reviewed data to ensure quality and precision. These factors explain the high rate of completeness and accuracy of data.

#### **4- Weaknesses of the study**

The main limitations of this study were:

- Its retrospective and monocentric design, which a limited number of patients included
- The expensive and difficult access to laparoscopy in low- and mid--income countries make the replication of this study quiet challenging in less equipped centres in other regions. This study was conducted in a tertiary centre that provides access to the technology and expensive medical devices to perform advanced laparoscopic procedures.

## **5- Perspectives and recommendations**

- Our study is monocentric with a small patient population, not reflecting the current state of laparoscopy in the country. Therefore, a multicentre study with a larger patient volume would be more informative.
- The implementation of laparoscopy for advanced abdominal procedures in Morocco is only recent, and therefore not all surgeons have mastered the technique yet. In addition, there are few training courses dedicated to advanced laparoscopic techniques in the country. Continuing education in minimally invasive surgery should be introduced and generalized to increase the rate of laparoscopy use.
- The place of laparoscopy for rectal cancer surgery is still debatable and it is still unclear in limited resources contexts. To move forward, we propose the creation of a prospective national database that would answer this question based on real-life data from Moroccan centers.



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## *Conclusion*

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## **V. Conclusion**

In our study, we evaluated the short-term outcomes of laparoscopy with open surgery for rectal cancer. The results were comparable to those described in the literature corroborating those from randomized and non-randomized trials.

Using a modern composite criterion, no differences were found between the two techniques in the achievement of Textbook outcomes.

The occurrence of postoperative complications was not significantly different between the two techniques, except for longer operative time in the laparoscopy group.

Even though two randomized trials failed to prove the non-inferiority of laparoscopy to open surgery in rectal cancer surgery, this technique remains commonly employed even if its place is still controversial. As there is a trend to adopt minimal invasive surgery, laparoscopy may be a solid option in the surgical treatment of rectal cancer, even in contexts similar to ours.

Additional conclusive studies are to be conducted in order for laparoscopic surgery to become the reference treatment and be widely accepted among the medical community.



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# *Abstract*

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## **Abstract**

**Title:** Short-term results of laparoscopy versus laparotomy for rectal cancer surgery: a retrospective study

**Author:** Soundouss Sebbata

**Keywords:** rectal neoplasms, laparoscopy, morbidity, textbook outcomes

**Objectives:** The main aim of this study was to compare textbook outcomes between laparotomy and laparoscopy for rectal cancer surgery. Secondary aims were to compare the postoperative morbidity and mortality and the quality of resection between the two techniques.

**Methods:** This retrospective study was conducted in the digestive surgical oncology department at the National Institute of Oncology in Rabat. It included all consecutive patients aged over 16 years, who underwent a curative resection for primary rectal adenocarcinoma between January 1, 2018 and December 31, 2021. Textbook outcome (TO) is a composite outcome that is achieved if all the following conditions are met: no mortality, no reintervention, no readmission, no postoperative complications > grade II according to the Clavien-Dindo classification, R0 resection. All morbidity-mortality outcomes were assessed 90 days after surgery.

**Results:** The total population included 96 patients in the laparotomy group and 162 in the laparoscopy group. There were statistically more patients with extended resection in the laparotomy group. TO rates were significantly higher in the laparoscopy group (69.4% vs. 30.6%,  $p=0.03$ ). No statistically significant differences were found concerning morbidity and resection quality. A secondary analysis was performed after excluding patients with extended resection. There were 56 patients in the laparotomy group and 136 in the laparoscopy group. No differences were found in patients' and disease characteristics. TO rates were non-significantly higher in the laparoscopy group (52.9% vs. 42.9%,  $p=0.41$ ). No statistically significant differences were found concerning morbidity and resection quality.

**Conclusion:** This study showed comparable short-term results between laparoscopy and open surgery rectal resections for composite (textbook outcome) and individual outcomes (morbidity and quality of resection). Laparoscopy could be considered as a solid option for rectal cancer surgery.

## **Résumé**

**Titre :** Résultats à court terme de la laparoscopie versus la laparotomie dans la chirurgie du cancer du rectum : Étude rétrospective

**Auteur :** Soundouss Sebbata

**Mots clés :** tumeurs rectales, laparoscopie, morbidité.

**Objectifs :** L'objectif principal de cette étude a été de comparer le “textbook outcome” entre la laparotomie et la laparoscopie pour la chirurgie du cancer rectal. Les objectifs secondaires étaient de comparer la morbi-mortalité postopératoire et la qualité de la résection entre les deux techniques.

**Méthodes :** Cette étude rétrospective a été réalisée dans le service d'oncologie chirurgicale digestive de l'Institut National d'Oncologie de Rabat. Elle a inclus tous les patients consécutifs âgés de plus de 16 ans, qui ont subi une résection curative pour un adénocarcinome rectal primitif entre le 1er janvier 2018 et le 31 décembre 2021. Le “textbook outcome” (TO) est un résultat composite qui est atteint si toutes les conditions suivantes sont remplies : pas de mortalité, pas de réintervention, pas de réadmission, pas de complications postopératoires > grade II selon la classification de Clavien-Dindo, résection R0. Tous les résultats de morbi-mortalité ont été évalués 90 jours après la chirurgie.

**Résultats :** La population totale comprenait 96 patients dans le groupe laparotomie et 162 dans le groupe laparoscopie. Il y avait statistiquement plus de résections étendues dans le groupe laparotomie. Les taux de TO étaient significativement plus élevés dans le groupe laparoscopie (69,4 % contre 30,6 %  $p = 0,03$ ). Aucune différence statistiquement significative n'a été trouvée concernant la morbidité et la qualité de la résection. Une analyse secondaire a été réalisée après exclusion des patients avec une résection étendue. Il y avait 56 patients dans le groupe laparotomie et 136 dans le groupe laparoscopie. Aucune différence n'a été trouvée dans les caractéristiques des patients et de la maladie. Les taux de TO étaient non significativement plus élevés dans le groupe laparoscopie (52,9 % contre 42,9 %  $p = 0,41$ ). Aucune différence statistiquement significative n'a été trouvée concernant la morbidité et la qualité de la résection.

**Conclusion :** Cette étude a montré des résultats comparables à court terme entre la laparoscopie et la laparotomie pour résection rectale, que ce soit pour les résultats composites (TO) et individuels (morbidité et qualité de la résection). La laparoscopie pourrait être considérée comme une option solide pour la chirurgie du cancer du rectum.

## ملخص

**العنوان:** النتائج قصيرة المدى للتنظير البطني مقابل شق البطن لجراحة سرطان المستقيم: دراسة بأثر

رجعي

**المؤلف:** سندس سباطة

**الكلمات الأساسية:** أورام المستقيم ، تنظير البطن، المضاعفات

**الأهداف:** الهدف الرئيسي من هذه الدراسة هو مقارنة نتائج الكتب المدرسية “textbook outcome” بين شق البطن وتنظير البطن لجراحة سرطان المستقيم. كانت الأهداف الثانوية هي مقارنة المراضة والوفيات بعد الجراحة ونوعية الاستئصال بين الطريقتين.

**الطرق:** أجريت هذه الدراسة بأثر رجعي في قسم جراحة الجهاز الهضمي للأورام بالمعهد الوطني للأورام بالرباط. شملت جميع المرضى المتتاليين الذين تزيد أعمارهم عن 16 عامًا ، والذين خضعوا لعملية استئصال علاجي لسرطان غدي في المستقيم الأولي بين 1 يناير 2018 و 31 ديسمبر 2021. نتيجة الكتاب المدرسي (TO) هي نتيجة مركبة تتحقق إذا تم استيفاء جميع الشروط التالية: لا يوجد وفيات ولا إعادة تدخل ولا إعادة قبول ولا مضاعفات ما بعد الجراحة < الدرجة الثانية وفقًا لتصنيف Clavien-Dindo ، استئصال OR. تم تقييم جميع نتائج معدل المضاعفات بعد 90 يومًا من الجراحة.

**النتائج:** شمل مجموع 96 مريضًا في مجموعة فتح البطن و 162 في مجموعة تنظير البطن. كان هناك إحصائياً أكثر من المرضى الذين يعانون من الاستئصال المطول في مجموعة فتح البطن. كانت معدلات TO أعلى بشكل ملحوظ في مجموعة تنظير البطن (69.4% مقابل 30.6%  $p = 0.03$ ). لم يتم العثور على فروق ذات دلالة إحصائية فيما يتعلق بالمراضة وجودة الاستئصال. تم إجراء تحليل ثانوي بعد استبعاد المرضى الذين يعانون من الاستئصال المطول. كان هناك 56 مريضًا في مجموعة فتح البطن و 136 في مجموعة تنظير البطن. لم يتم العثور على اختلافات في خصائص المرضى والمرضى. كانت معدلات TO أعلى بشكل غير معنوي في مجموعة تنظير البطن (52.9% مقابل 42.9%  $p = 0.41$ ). لم يتم العثور على فروق ذات دلالة إحصائية فيما يتعلق بالمراضة وجودة الاستئصال.

**الخلاصة:** أظهرت هذه الدراسة نتائج قصيرة المدى قابلة للمقارنة بين تنظير البطن واستئصال المستقيم بجراحة مفتوحة من أجل النتائج المركبة (نتائج الكتاب المدرسي) والنتائج الفردية (المراضة وجودة الاستئصال). يمكن اعتبار تنظير البطن خيارًا قويًا لجراحة سرطان المستقيم.



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# *Annexe*

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## WHO Performance Statut

Grade	Explanation of activity
0	Fully active, able to carry on all pre-disease performance without restriction
1	Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, e.g., light house work, office work
2	Ambulatory and capable of all selfcare but unable to carry out any work activities. Up and about more than 50% of waking hours
3	Capable of only limited selfcare, confined to bed or chair more than 50% of waking hours
4	Completely disabled. Cannot carry on any selfcare. Totally confined to bed or chair
5	Dead

## ASA Score,[59]

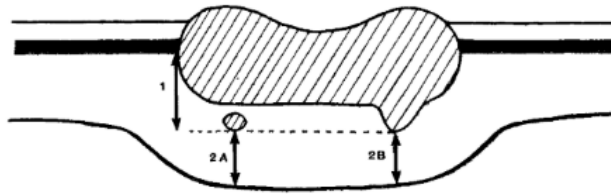
<b>ASA class</b>	<b>Definition</b>
I	A normally healthy patient
II	A patient with mild systemic disease
III	A patient with systemic disease which is not incapacitating
IV	A patient with an incapacitating systemic disease that is constant threat to life
V	A moribund patient who is not expected to survive for 24 h with or without operation

ASA - American Society of Anesthesiologists

## TNM Classification

TNM Clinical Classification		TNM Clinical Classification	
T – Primary Tumour		N – Regional Lymph Nodes	
TX	Primary tumour cannot be assessed	NX	Regional lymph nodes cannot be assessed
T0	No evidence of primary tumour	N0	No regional lymph node metastasis
Tis	Carcinoma <i>in situ</i> : Invasion of lamina propria*	N1	Metastasis in 1 to 3 regional lymph nodes
T1	Tumour invades submucosa	N1a	Metastasis in 1 regional lymph node
T2	Tumour invades muscularis propria	N1b	Metastasis in 2–3 regional lymph nodes
T3	Tumour invades subserosa or into non-peritonealised pericolic or perirectal tissues	N1c	Tumour deposit(s), i.e. satellites,   in the subserosa, or in non-peritonealised pericolic or perirectal soft tissue <i>without</i> regional lymph node metastasis
T4	Tumour directly invades other organs or structures <sup>†,‡,§</sup> and/or perforates visceral peritoneum	N2	Metastasis in 4 or more regional lymph nodes
T4a	Tumour perforates visceral peritoneum	N2a	Metastasis in 4–6 regional lymph nodes
T4b	Tumour directly invades other organs or structures	N2b	Metastasis in 7 or more regional lymph nodes
		M – Distant Metastasis	
		M0	No distant metastasis
		M1	Distant metastasis
		M1a	Metastasis confined to one organ (liver, lung, ovary, non-regional lymph node(s)) without peritoneal metastases
		M1b	Metastasis in more than one organ
		M1c	Metastasis to the peritoneum with or without organ involvement

### Circumferential Margin [47]



**Fig 2—Diagram to show measurements made on each slice.**

(1) Outer aspect of the muscular layer to the lateral limit of the tumour. (2) Outer limit of the tumour defined as the most lateral penetration of the mesorectum by tumour whether lymphatic (2A) or direct tumour spread (2B).

## Clavien Dindo Score [49]

Grade	Definition
Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications Blood transfusions and total parenteral nutrition are also included
Grade III	Requiring surgical, endoscopic or radiological intervention
Grade IIIa	Intervention not under general anesthesia
Grade IIIb	Intervention under general anesthesia
Grade IV	Life-threatening complication (including CNS complications)* requiring IC/ICU management
Grade IVa	Single organ dysfunction (including dialysis)
Grade IVb	Multiorgan dysfunction
Grade V	Death of a patient
Suffix “d”	If the patient suffers from a complication at the time of discharge (see examples in Table 2), the suffix “d” (for “disability”) is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication.

\*Brain hemorrhage, ischemic stroke, subarachnoidal bleeding, but excluding transient ischemic attacks.  
CNS, central nervous system; IC, intermediate care; ICU, intensive care unit.

## Anastomotic leakage grading [28]

Definition	Defect of the intestinal wall integrity at the colorectal or colo-anal anastomotic site (including suture and staple lines of neorectal reservoirs) leading to a communication between the intra- and extraluminal compartments. A pelvic abscess close to the anastomosis is also considered as anastomotic leakage.
Grade	<p>A      Anastomotic leakage requiring no active therapeutic intervention</p> <p>B      Anastomotic leakage requiring active therapeutic intervention but manageable without re-laparotomy</p> <p>C      Anastomotic leakage requiring re-laparotomy</p>



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# Hippocratic Oath

*At the time of being admitted as a member of the medical profession, I solemnly swear that:*

- *I will devote my life to serving humanity.*
- *I will treat my teachers with due respect and appreciation.*
- *I will practice my profession with conscience and dignity, with my patient's health as my first consideration.*
- *I will not betray the secrets that are confided in me.*
- *I will maintain by all the means in my power, the honour and the noble traditions of the medical profession.*
- *My colleagues will be my brothers.*
- *I will not permit considerations of religion, nationality, race, political or social standing to intervene between my duty and my patient.*
- *I will maintain the utmost respect for human life from the time of conception.*
- *Even under threat, I will not use my medical knowledge in a manner contrary to the laws of humanity.*
- *I pledge this freely and on my honour.*

# Serment d'Hippocrate

*Au moment d'être admis à devenir membre de la profession médicale, je m'engage solennellement à consacrer ma vie au service de l'humanité.*

- *Je traiterai mes maîtres avec le respect et la reconnaissance qui leur sont dus.*
- *Je pratiquerai ma profession avec conscience et dignité. La santé de mes malades sera mon premier but.*
- *Je ne trahirai pas les secrets qui me seront confiés.*
- *Je maintiendrai par tous les moyens en mon pouvoir l'honneur et les nobles traditions de la profession médicale.*
- *Les médecins seront mes frères.*
- *Aucune considération de religion, de nationalité, de race, aucune considération politique et sociale ne s'interposera entre mon devoir et mon patient.*
- *Je maintiendrai le respect de la vie humaine dès la conception.*
- *Même sous la menace, je n'userai pas de mes connaissances médicales d'une façon contraire aux lois de l'humanité.*
- *Je m'y engage librement et sur mon honneur.*

# قسم أبقر اط

بسم الله الرحمان الرحيم

أقسم بالله العظيم

في هذه اللحظة التي يتم فيها قبولي عضوا في المهنة الطبية أتعهد علانية:

- أنا أكرس حياتي لخدمة الإنسانية.
- وأنا أحترم أساتذتي وأعترف لهم بالجميل الذي يستحقونه.
- وأنا أمارس مهنتي بوازع من ضميري وشرفي جاعلا صحة مريض هدي الأول.
- وأنا لا أفشي الأسرار المعهودة إلي.
- وأنا أحافظ بكل ما لدي من وسائل على الشرف والتقاليد النبيلة لمهنة الطب.
- وأنا أعتبر سائر الأطباء إخوة لي.
- وأنا أقوم بواجبي نحو مرضاي بدون أي اعتبار ديني أو وطني أو عرقي أو سياسي أو اجتماعي.
- وأنا أحافظ بكل حزم على احترام الحياة الإنسانية منذ نشأتها.
- وأنا لا أستعمل معلوماتي الطبية بطريق يضر بحقوق الإنسان مهما لاقيت من تهديد.
- بكل هذا أتعهد عن كامل اختيار ومقسما بالله.

والله على ما أقول شهيد.



المملكة المغربية  
جامعة محمد الخامس بالرباط  
كلية الطب والصيدلة  
الرباط



سنة : 2023  
أطروحة رقم: 48

# النتائج قصيرة المدى للتنظير البطني مقابل شق البطن لجراحة سرطان المستقيم: دراسة بأثر رجعي

## أطروحة

قدمت ونوقشت علانية يوم : / / 2023

## من طرف

السيدة سندس سباطة

المزودة في 27 يونيو 1996 بالرباط

طبيبة داخلية بالمركز الاستشفائي الجامعي ابن سينا بالرباط

## لنيل شهادة

دكتوراة في الطب

الكلمات الأساسية : أورام المستقيم ؛ تنظير البطن؛ المضاعفات

## أعضاء لجنة التحكيم:

رئيس

السيد رؤوف محسن

عضو

أستاذ جراحة أورام الجهاز الهضمي

عضو

السيد مجبر محمد أنس

عضو

أستاذ جراحة أورام الجهاز الهضمي

عضو

السيد بن قابو أمين

أستاذ جراحة أورام الجهاز الهضمي

السيد بوشنتوف محمد

أستاذ في الجراحة العامة

السيد آيت علي عبد المنعم

أستاذ في الجراحة العامة