Comparison of clinical outcome and costs after laparoscopic versus open surgery for rectal cancer

Dr Amer Yehia Mohamed

PROFESSOR AND HEAD OF GENERAL SURGERY DEPARTEMENT

AL-Azhar Universty

Assuit Faculty of Medicine

Introduction

"Surgery remains the mainstay treatment modality in rectal cancer management".

The primary goals of treatment are to cure the patient, reduce local recurrence (LR), maximize disease-free survival (DFS), maintain function, and optimize quality of life.

*John E. Skandalakis

Goals of radical surgical resection are to:

(1) obtain adequate clearance around the tumor and tumor-free resection margins (proximal, distal, and circumferential)

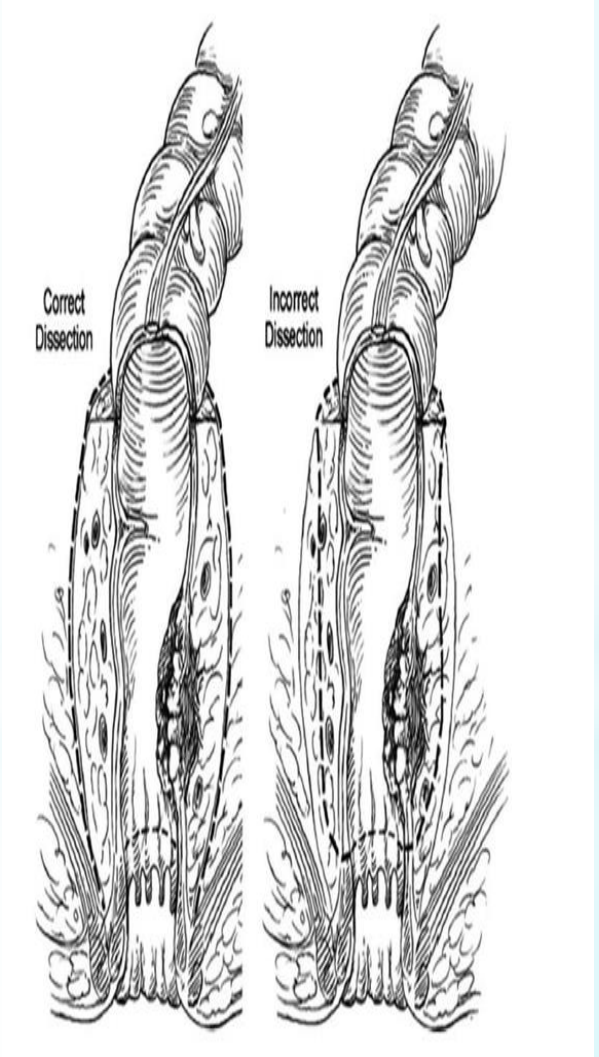
(2) remove LN-bearing mesorectum with an intact envelope (TME)

(3) ligate the IMA at its origin (or after left colic branch)

(4) harvest at least 12 or more regional LN

(5) minimize the risk of tumor perforation or rupture, and

(6) en bloc resection of any adherent structure.



* Recently, colorectal cancer has been a significant leading cause of death from malignancies worldwide.
* Conventional open surgery is associated with significant morbidity and long convalescence.
* Jacobs et al.,first reported the technical feasibility of laparoscopic colectomy in 1991.
* Since then, laparoscopic surgery has been widely operated for various benign colorectal conditions such as polyps, rectal prolapse and now colorectal cancer increasingly.

* Since the first laparoscopic colon resection over two decades ago, a multitude of studies have shown that laparoscopic colectomy is both safe and feasible, leading to its increasing use by colorectal and general surgeons.
* The benefits of laparoscopic surgery in comparison with open surgery have been suggested with respect to decreased morbidity, decreased pain, faster recovery, shorter hospital stay , decreased rate of wound infection , improved cosmesis and possibly reduced immunosuppression.

* Laparoscopic colorectal surgery is technically complex as it involves laparoscopic mobilization of colon over a wide area, intra-corporeal division of major vessels, extraction of specimen and a bowel anastomosis.
* There is a steep learning curve to achieve advanced laparoscopic skills, and specialized equipment is required.
* There are concerns with oncological outcome and safety of the laparoscopic procedure in colorectal cancer.
* There are also controversies with potential port-site recurrence after curative resection of tumor, hospital cost and lack of data on long-term oncological outcome.

* While laparoscopic surgery tends to have increased operating room costs due to instrumentation costs and operating room time, this is offset by a decreased length of stay, which tends to make overall costs equivalent between laparoscopic and open techniques for colon surgery.

* As surgeons become more proficient, it is possible that laparoscopy will become even more cost effective (**Delaney, 2016**).

*Aim of The Work :

* To determine whether laparoscopic resection for rectal cancer is feasible and safe as open resection, as determined by:

- Short-term surgical outcomes
- Pathologic evaluation of the resected proctectomy specimen&
- Postoperative morbidity.

* The study was conducted in Division of Colorectal Surgery, Case Western Reserve University (CWRU), USA, and surgical oncology department, South Egypt cancer institute, Assuit University from Dec 2015 to May 2017.
* Patients undergoing elective rectal cancer resection during the time of the study were selected.
* The study was conducted on 60 patients with rectal cancer to whom surgical resection was performed either laparoscopic or open, their data were prospectively collected.

Aim of the Study

Patients & Methods

Main Outcome Measures:

* The primary outcomes measured were short surgical outcomes, hospital length of stay, readmission, postoperative complications, and hospital mortality, ultimately the cost of care could be estimated.
* All consented patients assigned to undergo elective resection of primary rectal cancer and also recto sigmoid cases included in the study.

Exclusion criteria

- **• Patients with distant metastasis.**
- **• Locally advanced cancer infiltrating into adjacent organs (T4b).**
- **• Pregnancy.**
- **• Coagulopathy.**
- **• Severe cardio-pulmonary disease**
- **• Previous major colorectal surgery.**
- **• Patients presented in other emergency settings (perforation, obstruction and hemorrhage)**

Surgical Technique:

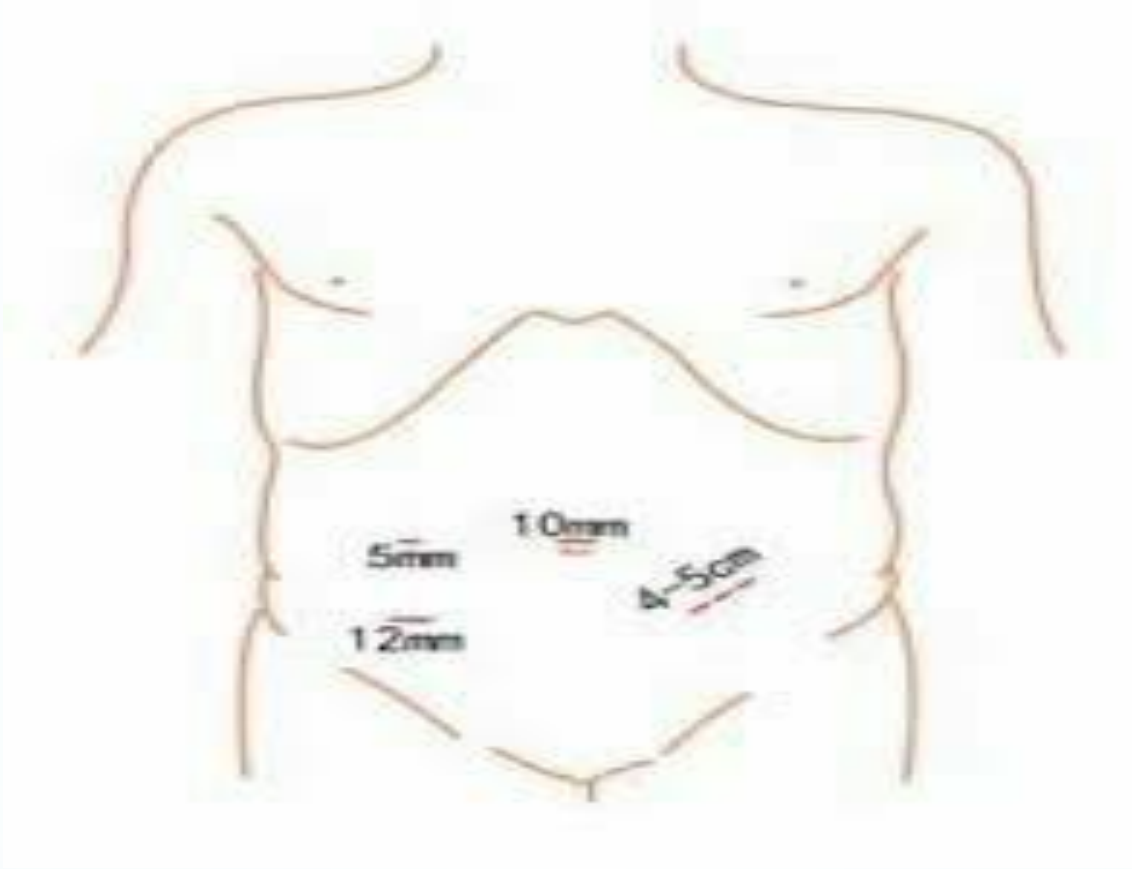
The following procedures were performed according to the location of the tumor:

* Anterior resection of Dexon (LAR) (72% of cases).
* Abdominoperineal resection (APR)
* Total colectomy.

* Laparoscopic Anterior Resection:

Patient positioning, port placement and initial steps are nearly identical to a sigmoid or left colon resection.

Patients are placed on a beanbag in lithotomy position. With the surgeon standing on the patient's right and assistant on the patient's left, a 10 mm infraumbilical port is placed, followed by a 12 mm right lower quadrant port, and left lower quadrant port, both 2-3 cm medial and superior to the anterior superior iliac spines.

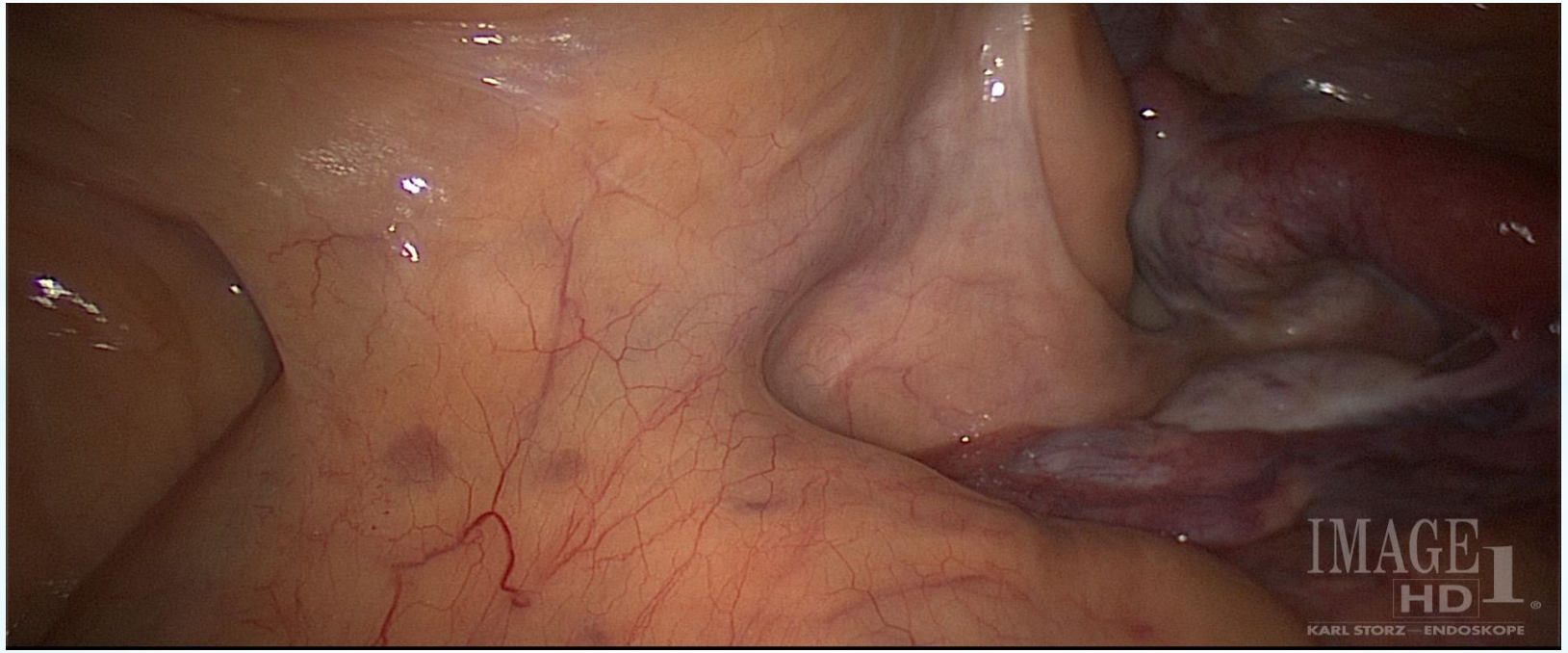


* The port sites

* For LAR requiring a temporary ileostomy, the right lower quadrant port is placed at the ostomy site, and this will likely be used as the specimen extraction site.

* A 5 mm port is placed in the right upper quadrant, at least one hand's breadth away from the infraumbilical and right lower quadrant ports (Delaney, 2016).

* Thorough inspection of the abdomen for evidence of metastatic disease for oncologic resections. Trendelenberg position with the left side up. Utilizing a medial to lateral approach, the mesentery over the inferior mesenteric vessels is tented up and sharply dissected making sure to preserve the left ureter and autonomic presacral nerves.



* High ligation of the inferior mesenteric artery for a complete mesocolic resection is performed for oncologic resections. Dissection continues in the retroperitoneal plane superiorly, leaving Gerota's fascia intact. The inferior mesenteric vein is ligated just inferior to the pancreas.

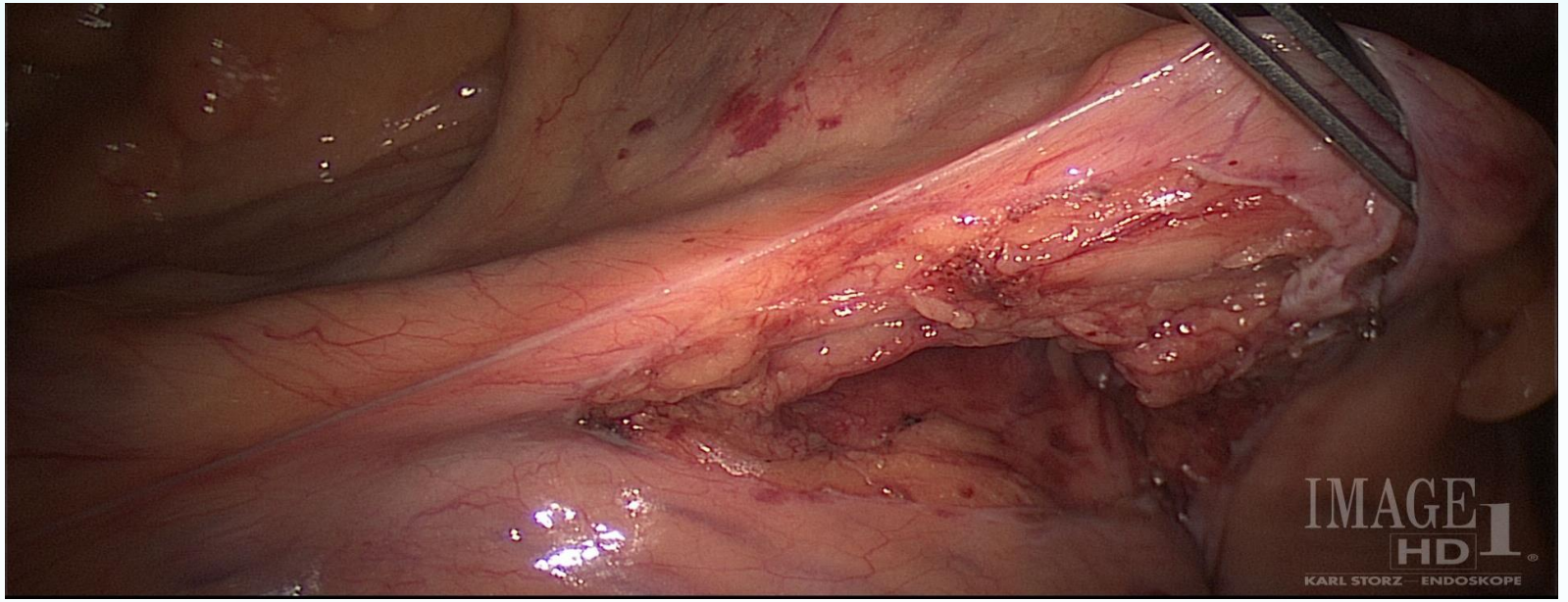
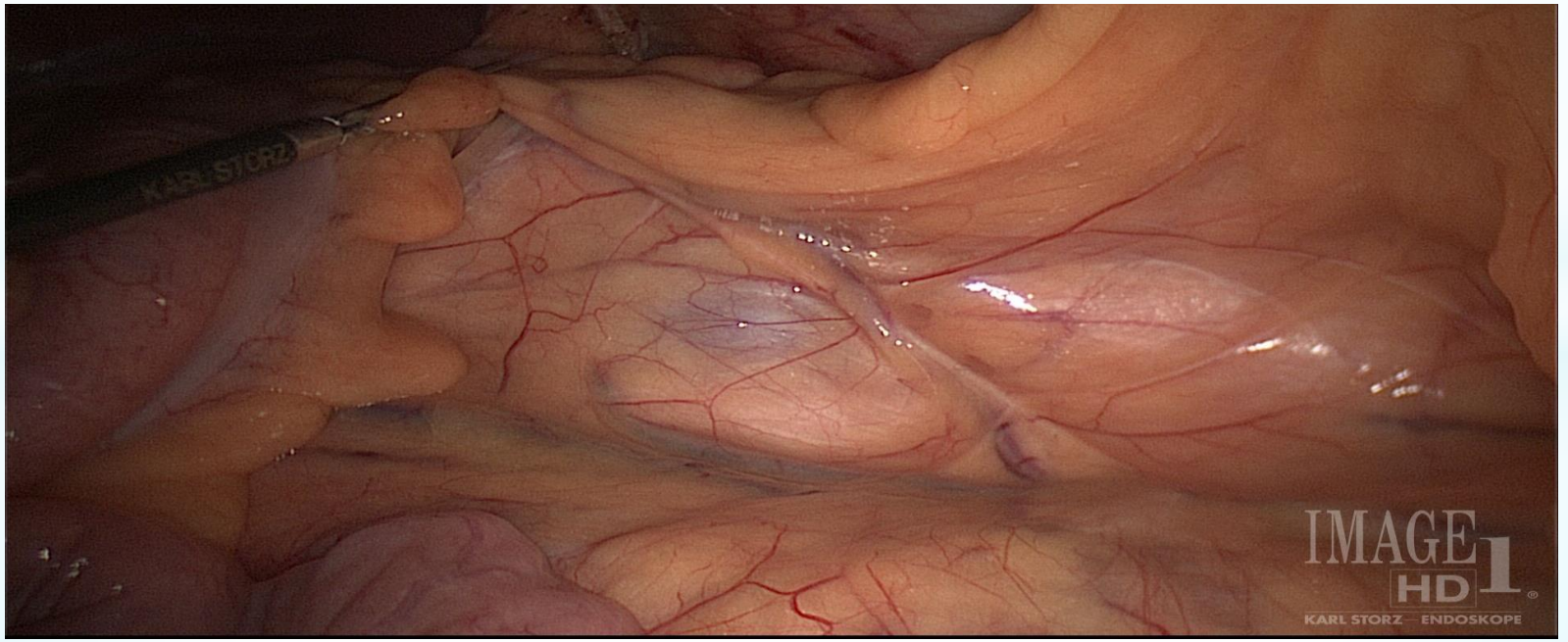
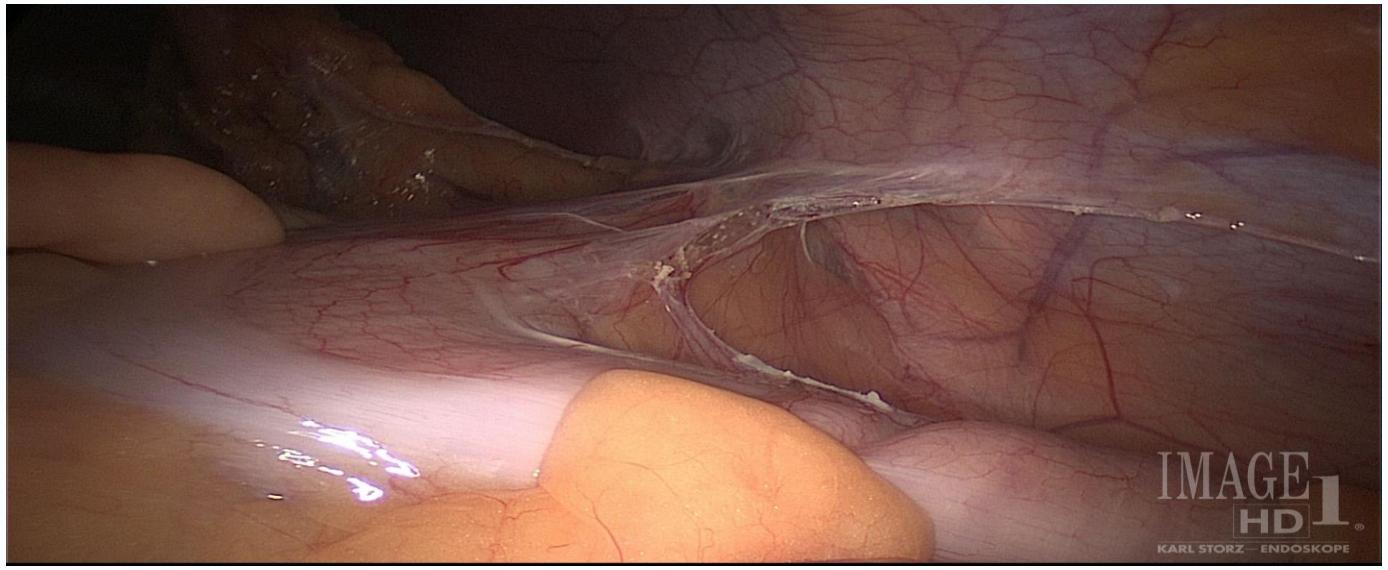
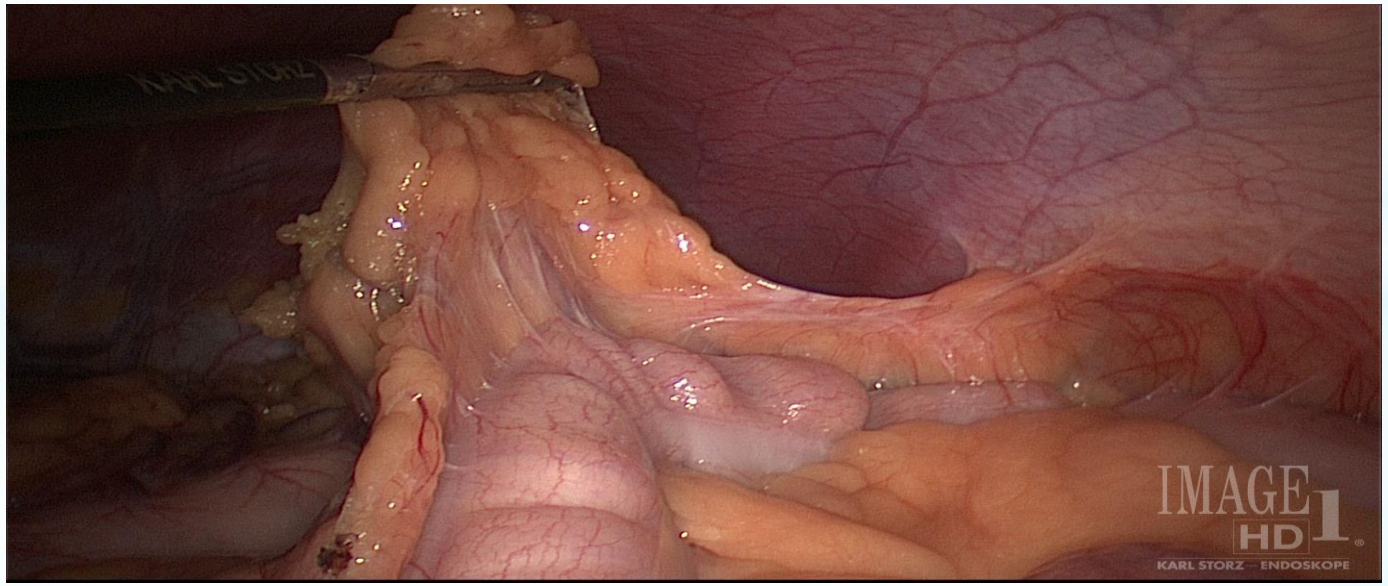


IMAGE 1 HD
KARL STORZ — ENDOSKOPE


KARL STORZ
IMAGE 1 HD
KARL STORZ — ENDOSKOPE

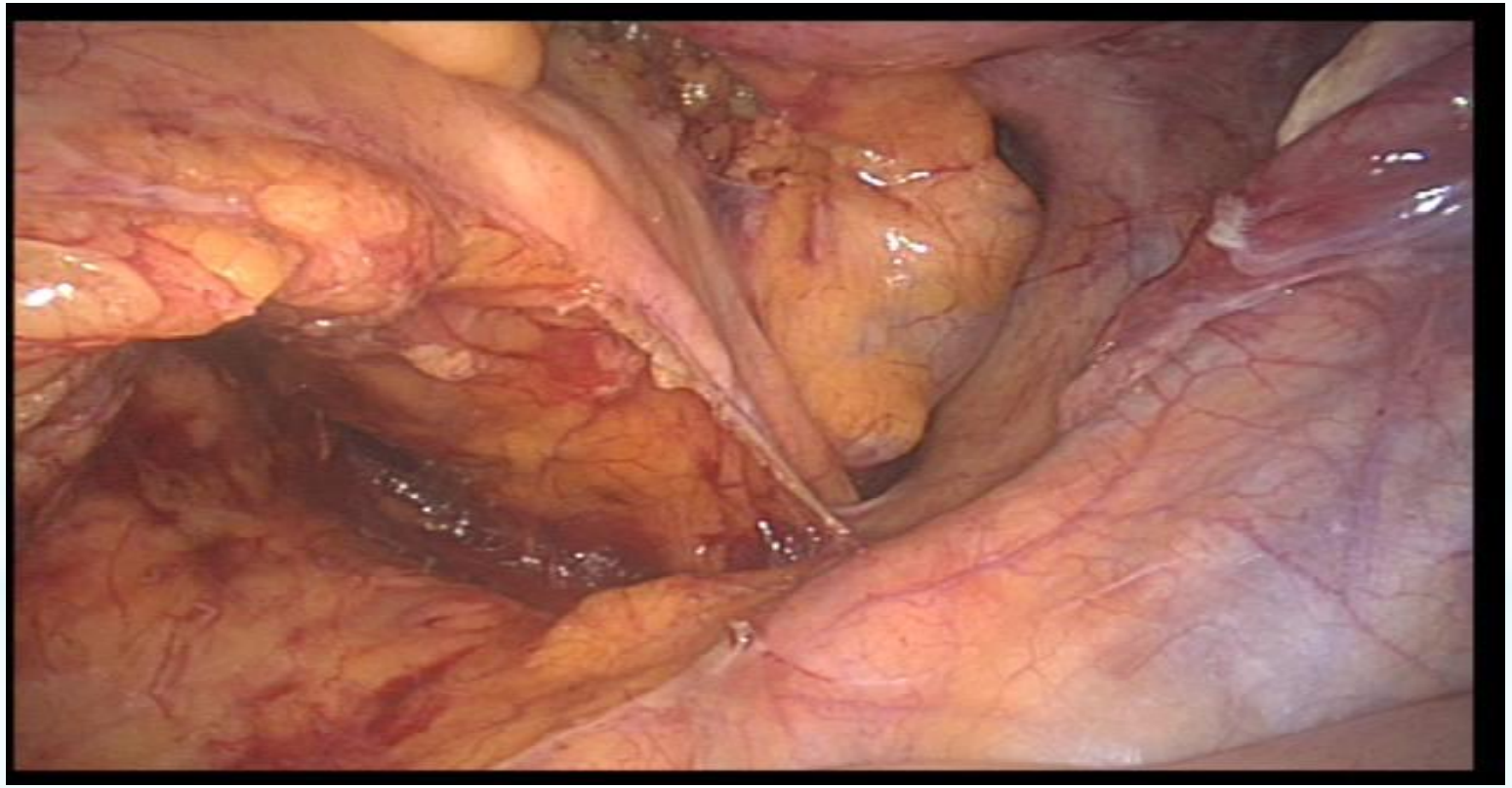
* Splenic flexure mobilization,lat dissection then bet greater omentum and tr colon:





* The mesorectal dissection is the next part of the procedure. The patient is placed back in Trendelenberg position and the small bowel swept away from the pelvis. With the assistant retracting the recto sigmoid junction cranially and slightly anteriorly, the avascular presacral mesorectal plane is identified.

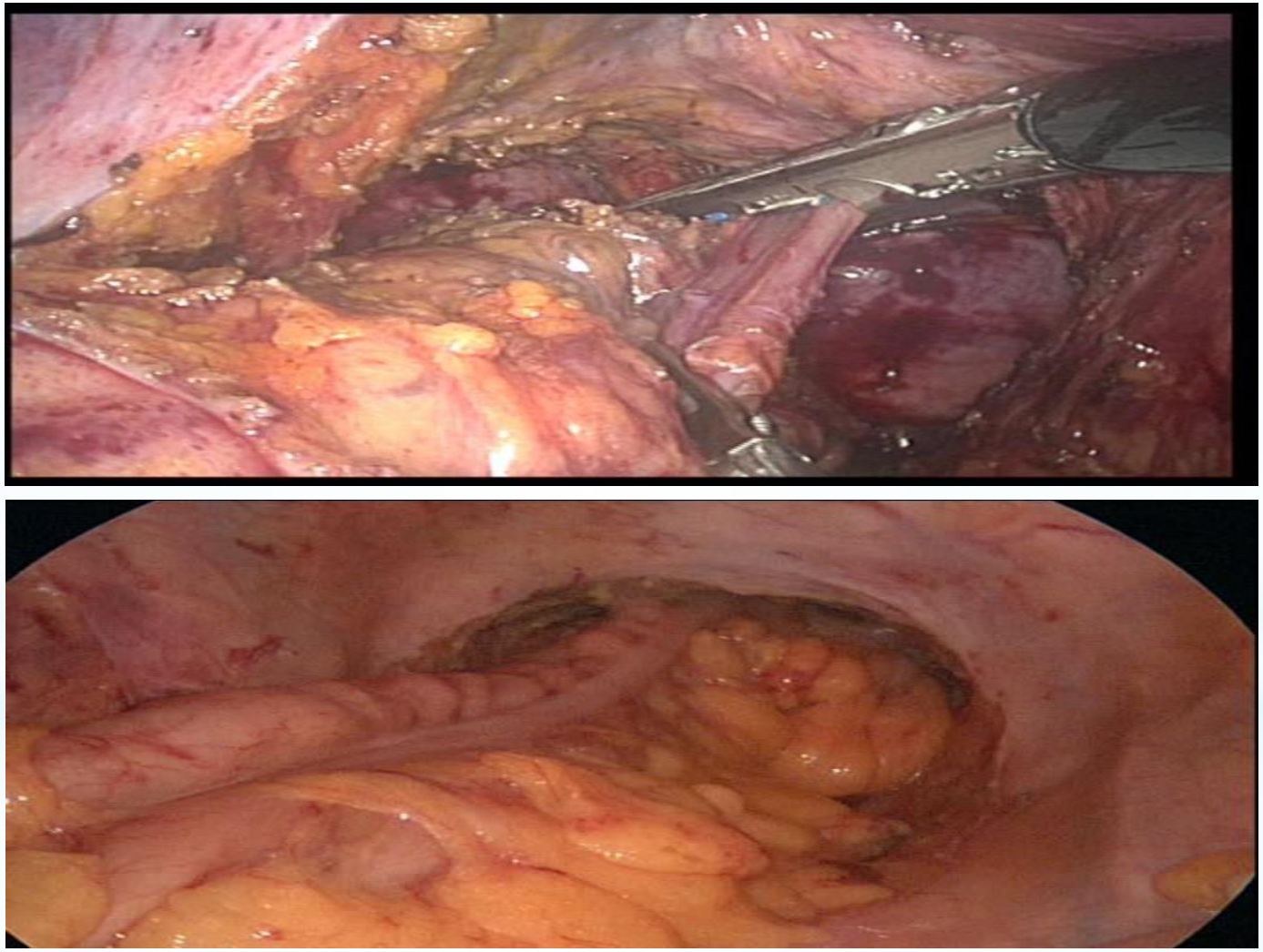
* Dissection starts posteriorly and is carried out using cautery, between the presacral fascia and the fascia propria of the mesorectum, thereby preserving the autonomic nerves posteriorly .



* As dissection continues inferiorly, Waldeyer's fascia is divided and dissection follows the anterior curve of the sacrum.
* The right and left sides of the mesorectum are then mobilized, paying great care to observe the fascia of the pelvic sidewall, thereby protecting the iliac vessels, ureters, and autonomic nerve plexi in the pelvic sidewall.

* The dissection concludes where the rectum narrows into the anal canal, and where the levators curve down into the anal canal.
* When an adequate margin can be obtained, the bowel can be divided with an Endo GIA stapler inserted through the right lower quadrant (ostomy site) port .

* Demonstration of staple line at anorectal junction , Tension free side to end colonanal anastomosis :



* This may not be possible in patients with a deep, narrow pelvis or with a very low dissection thus necessitating a transanal intersphincteric dissection with perineal specimen extraction and hand sewn colonanal anastomosis, usually required for tumors within 2 cm of the dentate line.

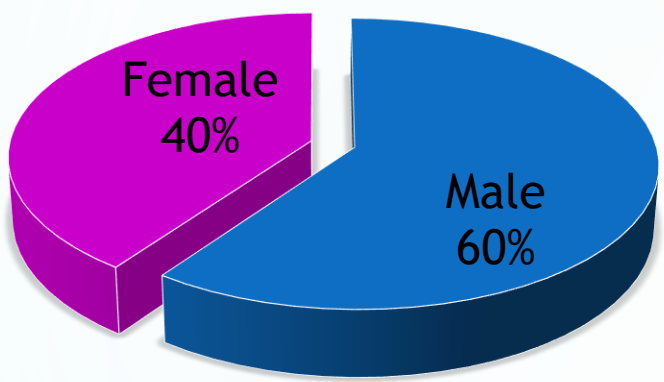
* For patients able to undergo stapled resection, the distal end of the specimen may be brought out through the infraumbilical or lower quadrant port sites with wound protector in place.

* A leak test is also performed .

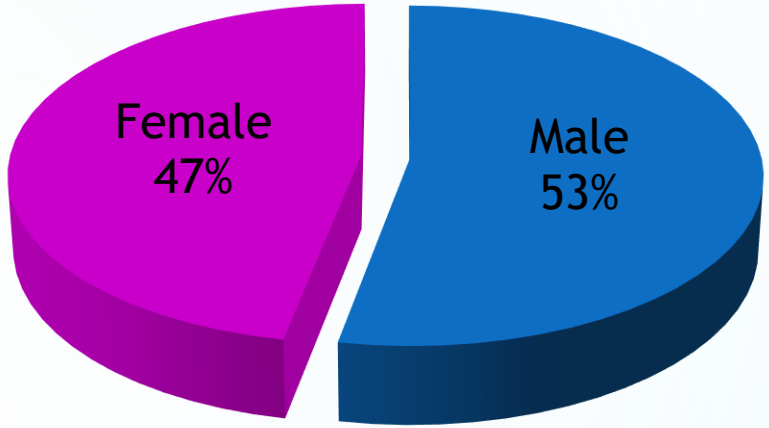
* A diverting loop ileostomy is created in the right lower quadrant, the site having been marked preoperatively by an enterostomal therapist (Delaney, 2016).

Results

Laparoscopic Group



Open Group



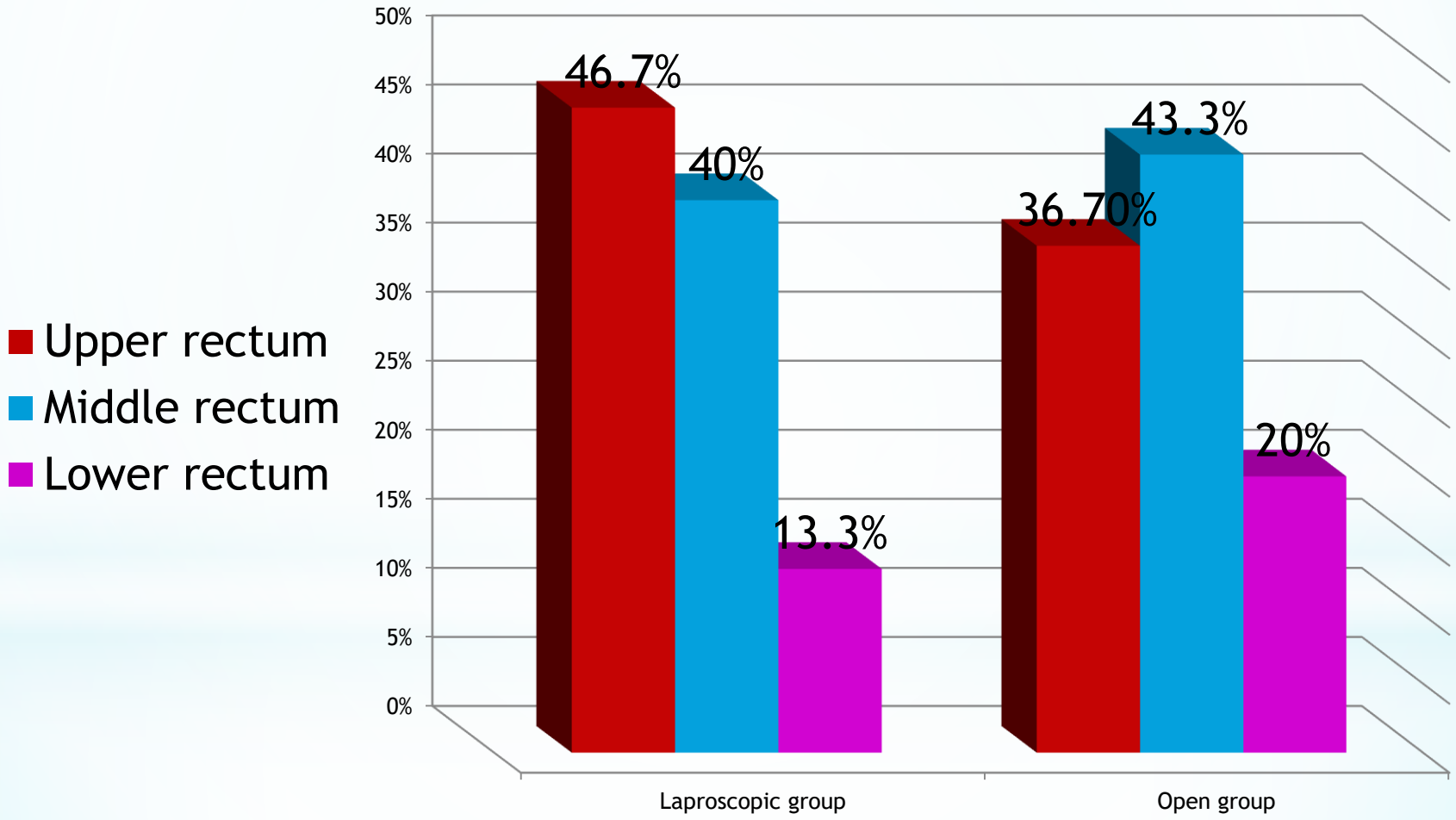
Gender

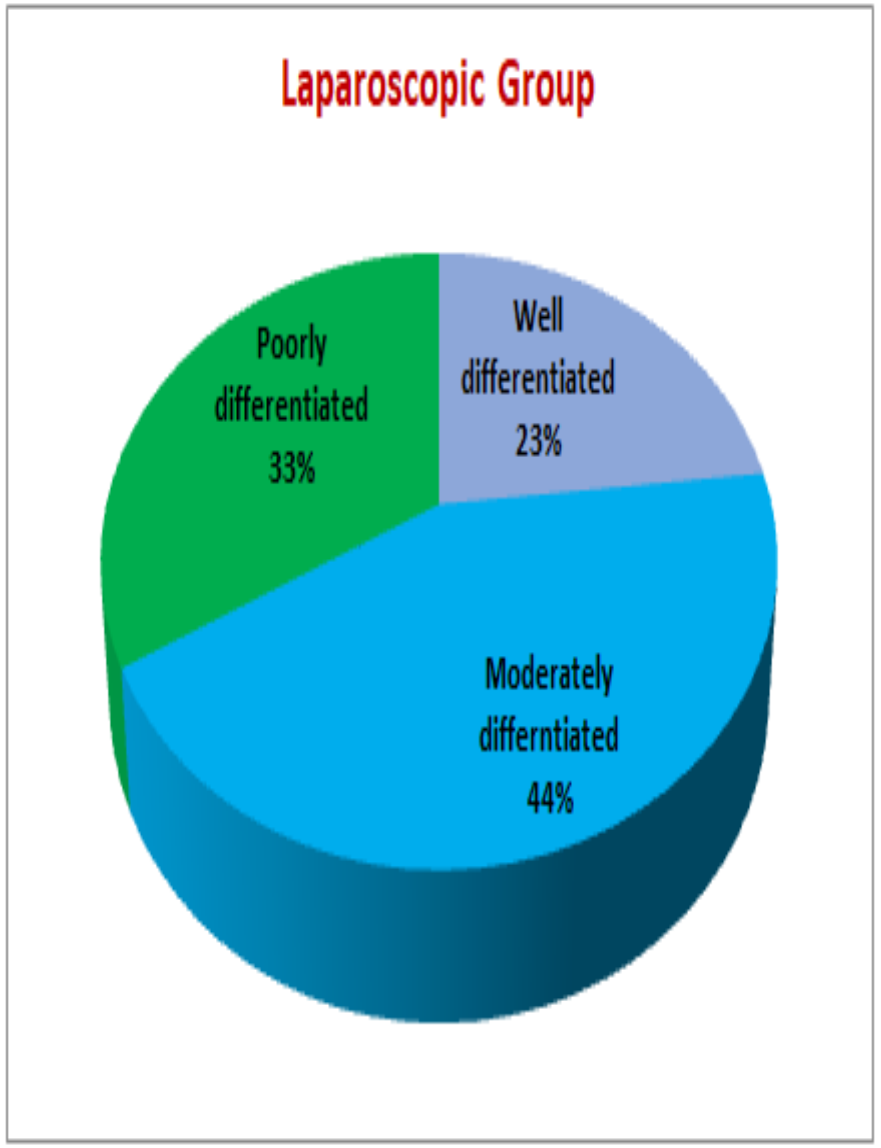
This study included a total number of **60 patients** of **rectal cancer.**
30 cases of whom underwent **laparoscopic resection** & were compared with **30 patients** to whom **conventional resection** were done.

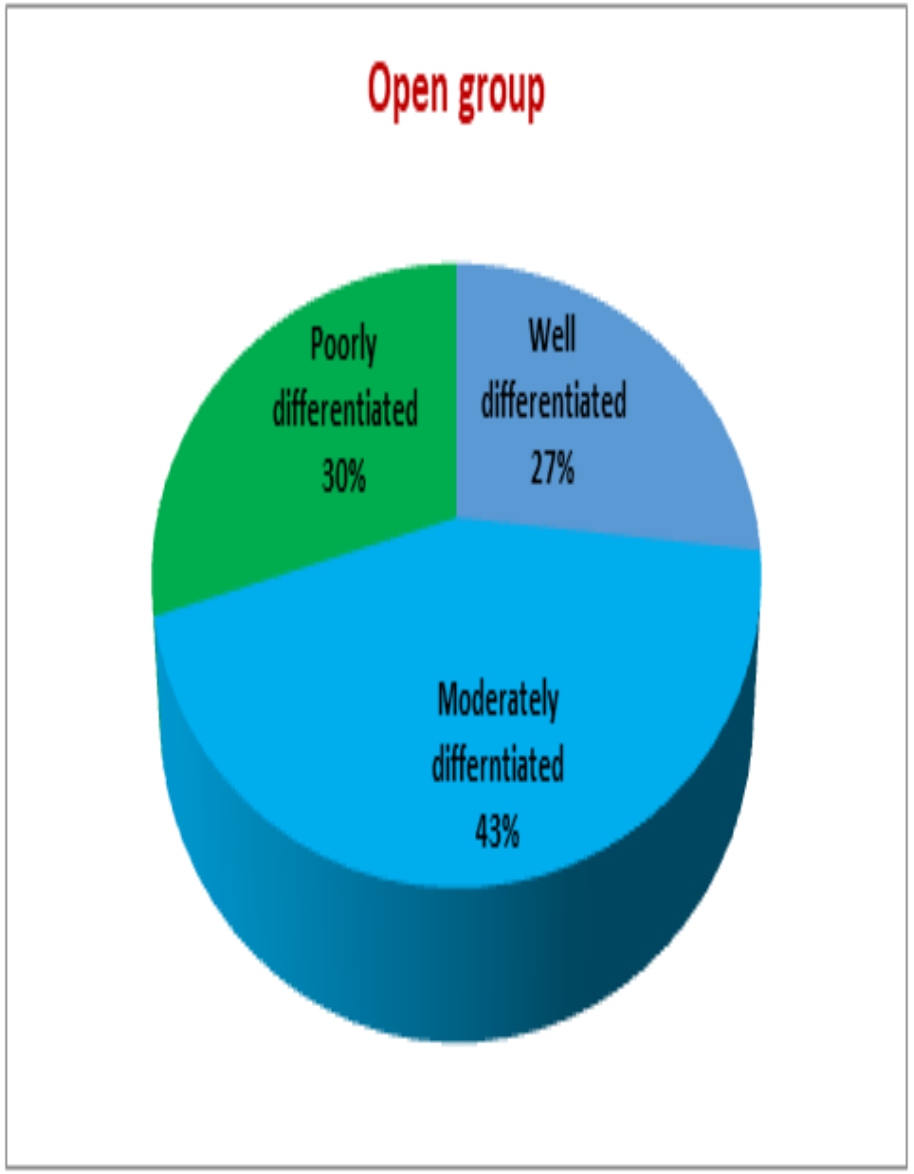
Demographic data- Cont.

Variable	G (LC)	G (OC)	P. value
Age /years 1. Range 2. Mean ± SD	 22 – 69 Y 46 ± 11 Y	 14 – 68 Y 48 ± 11 Y	0.56^{Ns}
BMI	24.8±1.4	25.1±1.3	0.5^{Ns}

Tumor Characteristics
Site of the Tumor

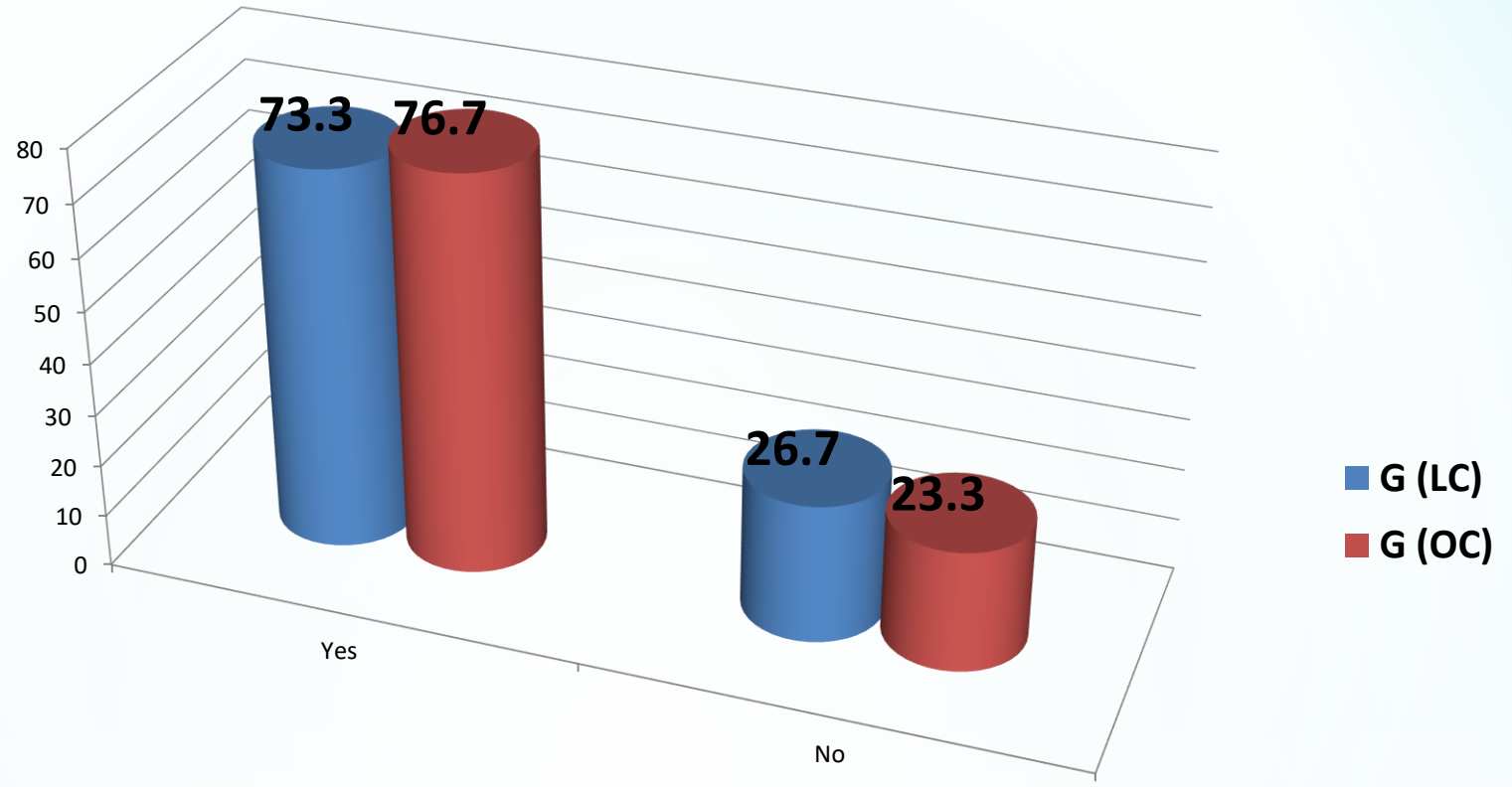






* Histological Grading

P. Value =0.37^{Ns}

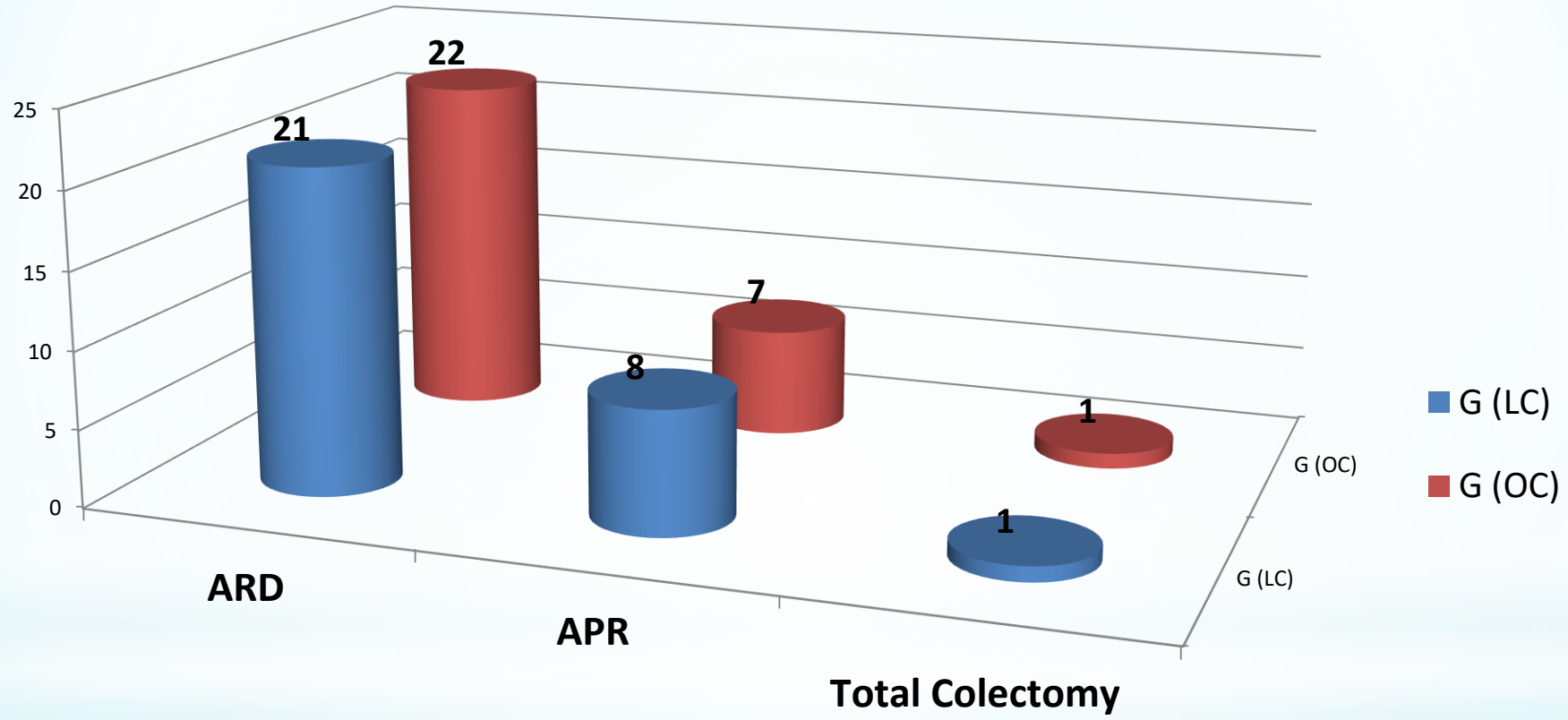


	Yes	No
G (LC)	73.3	26.7
G (OC)	76.7	23.3

*Neoadjuvant RTH

Operative Data

Extent of resection



	ARD	APR	Total Colectomy
G (LC)	21	8	1
G (OC)	22	7	1

Operative Data - Cont.

Variable	LC (30)	OC (30)	P. value
Surgery duration Mean ± SD	180±44	162.5±35.	0.004*
Blood transfusion	3(10.0%)	5(16.7%)	0.15^{Ns}
Ileostomy	12 (40%)	13 (43.3%)	0.7 ^{Ns}

Postoperative Data:

Variable	LC (30) (Mean ± SD)	OC (30) (Mean ± SD)	P. value
Analgesia (days)	4.9±1.8	7.6±2.9	0.001*
Passing Flatus (hours)	61.2±26	71.3±10.9	0.003*
1st bowel motion (hours)	74.6±28	81 ±10.6	0.02*
Hospital stay (days)	6.4±2.2	9.4±3.2	0.007*

Post-operative Complications

Variable	G (LC)	G (OC)	P. value
Sexual and urinary complications	2(6.6%)	3(9.9%)	0.31
Wound infection	1(3.3%)	3(9.9%)	0.08
Anastomotic leakage	2(6.6%)	2(6.6%)	0.56
Prolonged ileus (>4 days)	2(6.6%)	4(13.2%)	0.12
Chest infection	1(3.3%)	2(6.6%)	0.4

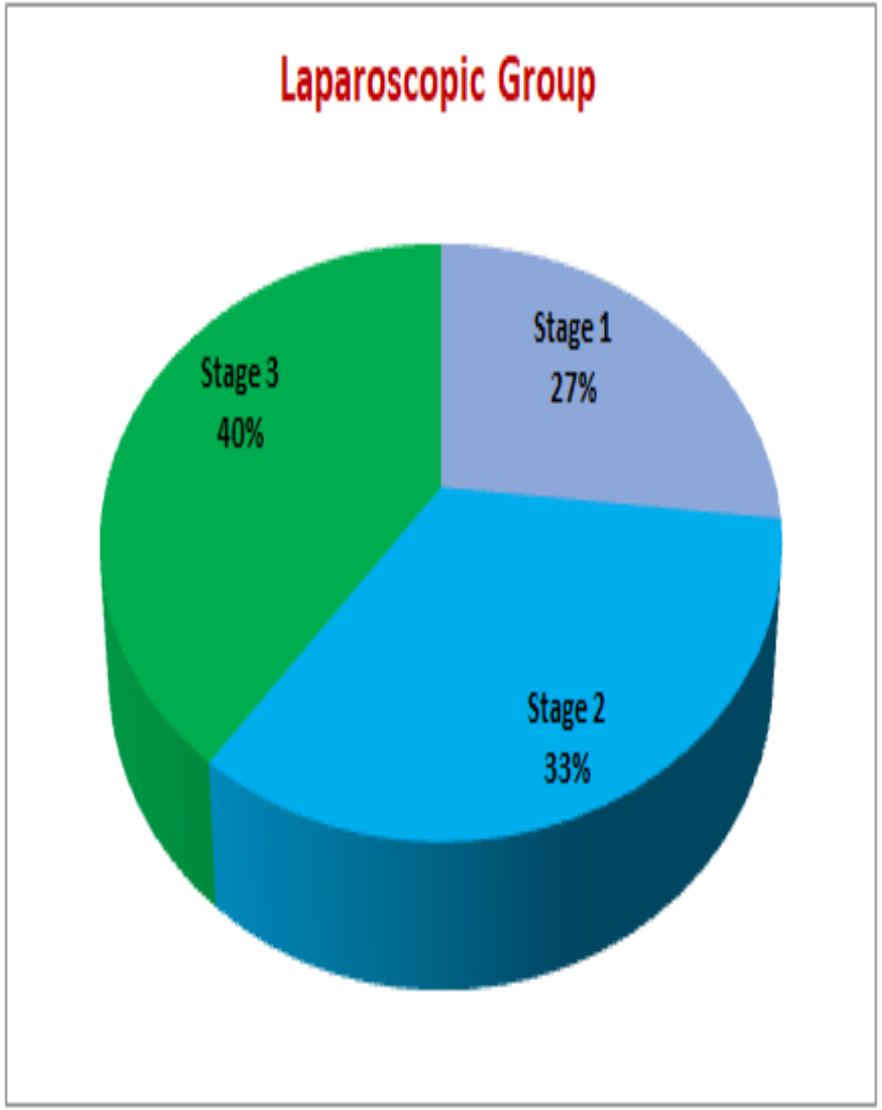
Post-operative Complications - Cont.

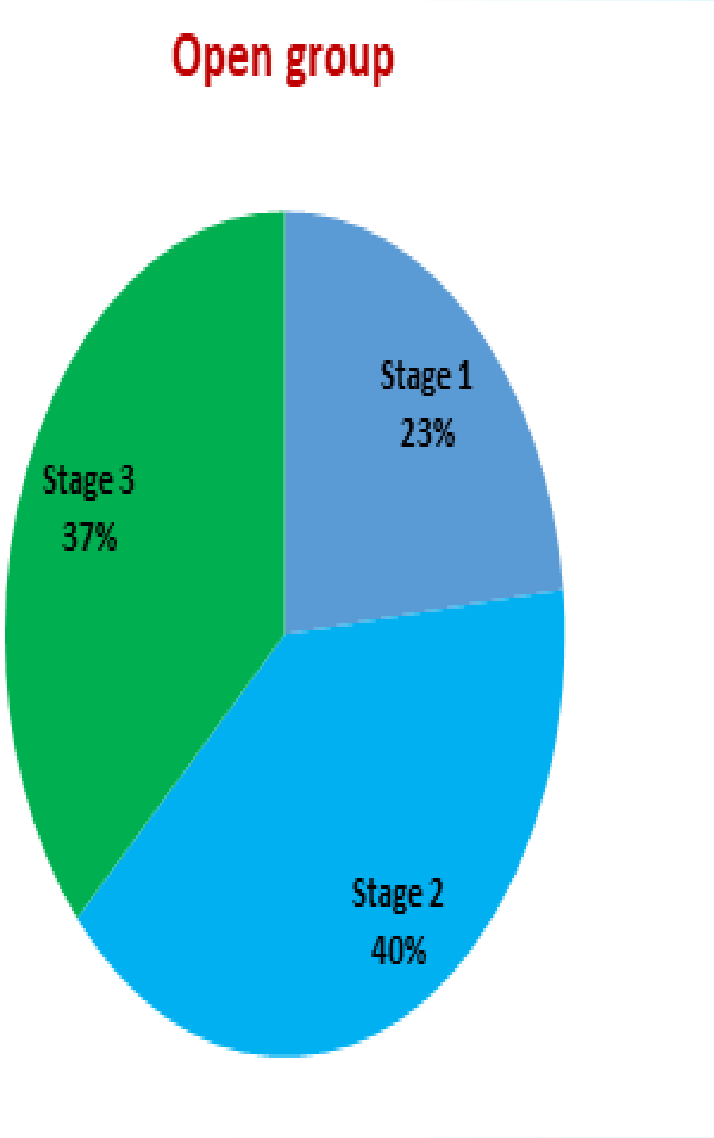
Variable	G (LC)	G (OC)	P. value
Hospital Mortality	0(0.0%)	0(0.0%)	NA
30-day Readmission	3(9.9%)	3 (9.9%)	0.54
Reoperation (n, %)	2 (6.6%)	3 (9.9%)	0.31
Total	8(26.7%)	14(46.7%)	0.03*

Pathologic Outcomes

Variable	LC (30)	OC (30)	P. value
Total length of resected specimen	22.3± 11.5	22.7± 12.6	0.86^{Ns}
Harvested lymph nodes	15.1±3.4	16.6±3.7	0.27^{Ns}
CRM in cm	1.4±0.9	1.5± 0.8	0.49^{Ns}
Distal margin in CM	4.9±3.2	4.2± 2.6	0.15^{Ns}
Safety margins (Negative)	(100.0%)	(100.0%)	NA

* **No significant difference** was found between the 2 groups as regard total **length of resected specimen,** the **number of harvested lymph nodes** and the **vertical and circumferential margins.**
* Histological examination revealed that **proximal and distal margins** were **free of tumor cells in all surgical** specimens in both groups.





*Stage of Disease

P. Value = 0.36^{Ns}

The cost of care:

* There is an increasing trend to use laparoscopy for rectal cancer surgery.
* Although laparoscopic and open rectal resections appear oncologically equivalent, there is little information on the cost of different surgical approaches.
* With the current health care crisis and the importance of optimizing health care resources and patient outcomes, the cost of care is an important factor ***(Keller et al., 2014,and Fleshman et al ., 2015)***.

* A review of a prospective database for elective laparoscopic rectal cancer resections was performed by Professor Delaney on 2014 at case western medical center.

* The study reported that laparoscopy is cost-effective for rectal cancer surgery, improving both health care expenditures and patient outcomes.

* For selected patients, laparoscopic rectal cancer resection can reduce length of stay, operating time, and resource utilization . **(Keller and Delaney., 2014)**

Discussion :

* In our Study ,We found that there was 28% reduction in the mean analgesic requirement in the laparoscopic group which is statistically significant .
* The COST and the COLOR trials showed similar results.
* In the systemic review of 4013 patients from 17 RCT, Tjandra and Chan found that the patients who underwent laparoscopic colorectal surgery had a 12% reduction of pain scores and 30% reduction in the use of analgesics .

* (Tjandra and Chan, 2007).

* Duration of hospital stay in our study was significantly shortened in the laparoscopic group with 3 days shorter hospital stay. This is consistent with all randomized controlled trials.

* Similar result was observed in COLOR trial (3.6 days in laparoscopic resection versus 4.6 days in open resections) (Buunen et al., 2009),and Leung et al 2004

* Laparoscopic colorectal surgery takes invariably longer duration than its corresponding open surgery.
* In our study, there is significant prolongation of operative time in the laparoscopic group with mean operative time 180 minutes vs 162 minutes in the open group with p value 0.004.
* In ***COLOR*** trial laparoscopic operation was described as longer operation (Lap. 145 min, open 115 min, *p* value 0.0001)
*

* In our study there was no hospital mortality in both groups. In most randomized trials, the operative mortality did not show any statistical difference between the laparoscopic and open groups.
* Tjandra and Chan, in a systemic review, demonstrated that the overall operative mortality rates of laparoscopic and open colectomy were 0.6% and 2.01%, respectively (, p=0.005).

* (Tjandra and Chan, 2007).

* In our thesis, the operative morbidity was better in the laparoscopic group (26.7%) in comparison with the open group (46.7%), statistically significant (p=0.03).
* Two anastomotic leakages (6.6%) occurred in the laparoscopic group and the open group.
* The anastomotic leak reported in series of laparoscopic resection was consistently less than 10%, which was comparable to that of conventional open resection (Scheidbach et al., 2008).

* Despite the longer duration of laparoscopic operations, there is no increase in the intra or postoperative complications.
* Probably, the negative effect of the prolonged operating time in laparoscopic surgery is overrun by advantages such as decreases in hospital stay, wound infection, postoperative ileus and the postoperative pain.

*Summary & Conclusions

* The results showed significant decrease in the postoperative stay, pain, ileus in the laparoscopic group in comparison with the open group with significant increase in the operative time without adverse impacts in comparison with the open group.

* There was no significant difference in length of retrieved specimen, lymph node yield, nor resection margins between the 2 groups

* To conclude, laparoscopic rectal surgery is feasible, safe with better post-operative convalescence and similar oncological outcome to conventional surgery.
* Whenever available, further studies should be conducted to evaluate the long-term outcomes as regard: recurrence rate, overall survival and recurrence free survival.

Thank You