

**THE RETROSPECTIVE STUDY OF  
COST ANALYSIS AND SHORT TERM  
OUTCOME OF LAPAROSCOPIC AND  
OPEN ANTERIOR RESECTION  
PERFORMED IN HOSPITAL  
UNIVERSITI SAINS MALAYSIA.**

**By**

**DR. MAZWAN BIN MOHAMAD**

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## ABBREAVIATION

<b>LAR</b>	Laparoscopic anterior resection.
<b>OAR</b>	Open anterior resection.
<b>AR</b>	Anterior resection.
<b>LOS</b>	Length of stay.
<b>SD</b>	Standard deviation.
<b>HUSM</b>	Hospital Universiti Sains Malaysia.
<b>LPS</b>	Laparoscopic surgery.
<b>RCT</b>	Randomised controlled trial.
<b>OR</b>	Operation room.
<b>DST</b>	Directional stapling technology.
<b>CDH</b>	Circular detachable head stapler.
<b>CRM</b>	Circumferential radial margin.
<b>TNM</b>	Tumour Nodes Metastases.
<b>TME</b>	Total mesorectum excision.
<b>AXR</b>	Abdominal X-ray.
<b>CT scan</b>	Computed Tomography scan.
<b>J&amp;J</b>	Johnson & Johnson Company.
<b>GA</b>	General anaesthesia.
<b>RM</b>	Ringgit Malaysia

## **ABSTRAK**

# **KAJIAN RETROSPEKTIF ANALISIS KOS DAN KESAN JANGKA MASA PENDEK PEMBEDAHAN LAPAROSKOPIK DAN PEMBEDAHAN KONVENSIONAL BARAH REKTUM DI HOSPITAL UNIVERSITI SAINS MALAYSIA.**

*Dr Mazwan Mohamad,*

*MMed Pembedahan Umum.*

Jabatan Pembedahan,

Pusat Pengajian Sains Perubatan, Universiti Sains Malaysia,

Kampus Kesihatan,,16150 Kelantan, Malaysia.

**Latar Belakang:** Pembedahan laparoskopik barah rektum boleh meningkatkan kualiti selepas pembedahan dalam jangka masa pendek. Hanya beberapa kajian sahaja dibuat berkaitan dengan kepentingan kos rawatan di dalam cara pembedahan ini. Kajian ini adalah untuk mengkaji kelebihan kos rawatan and hasil pembedahan dalam jangka masa pendek antara pembedahan laparoskopik barah rectum dengan pembedahan konvensional barah rectum di Hospital Universiti Sains Malaysia. Ini merupakan kajian kos rawatan yang pertama dijalankan di pusat rawatan ini berkaitan dengan pembedahan barah rektum.

**Kaedah:** Seramai 115 orang pesakit telah dipilih melalui data retrospektif di jabatan rekod HUSM antara bulan Januari 2000 sehingga bulan Disember 2014. Mereka

semua telah menjalani pembedahan barah rektum sama ada secara laparoskopik atau pun konvensional. Data pesakit dikumpul di dalam borang data. Data-data dikumpul dan dianalisis menggunakan 'Pearson's Chi square' dan 'independent t-test'.

**Keputusan:** Umur pesakit terlibat adalah sekitar 58 ke 59 tahun. Pesakit yang paling muda adalah berumur 17 tahun dan yang paling tua adalah berumur 86 tahun (p 0.56). Etnik Melayu adalah majoriti di dalam kajian ini dengan kadar 90%. Kebanyakan pembedahan laparoskopik barah rektum dilaksanakan pada tahap barah rektum yang awal dan pertengahan. Manakala pembedahan konvensional dilaksanakan pada semua tahap barah rektum (p 0.001).

Pembedahan laparoskopik dan konvensional tidak menunjukkan perbezaan ketara di dalam hasil sempadan barah (p 0.345). Data komplikasi menunjukkan tiada perbezaan ketara di dalam dua cara pembedahan rektum ini (p 0.333). Pembedahan laparoskopik menunjukkan data yang ketara di dalam keseluruhan masa rawatan pesakit di ward (p 0.001).

Analisis kos rawatan menunjukkan perbezaan ketara di dalam kos penginapan pesakit di hospital (p 0.001), kos semasa pembedahan di dalam bilik bedah dengan penggunaan trokar besi laparoskopik (p 0.001) dan kos keseluruhan pembedahan dengan penggunaan trokar besi (p 0.001). Sementara kos-kos rawatan yang lain adalah tiada perbezaan statistik.

**Rumusan:** Kadar penyembuhan selepas pembedahan laparoskopik barah rektum adalah awal berbanding dengan pembedahan konvensional. Analisis kos menunjukkan pengurangan kos jika pembedahan menggunakan semula trokar di dalam pembedahan laproskopik.

**Kata Kunci:** pembedahan laparoskopik barah rektum, pembedahan terbuka barah rektum.

## ABSTRACT

### THE RETROSPECTIVE STUDY OF COST ANALYSIS AND SHORT TERM OUTCOME OF LAPAROSCOPIC AND OPEN ANTERIOR RESECTION PERFORMED IN HOSPITAL UNIVERSITI SAINS MALAYSIA.

*Dr Mazwan Mohamad,  
MMed General Surgery.*

Department of Surgery,  
School of Medical Sciences, Universiti Sains Malaysia,  
Health Campus, 16150 Kelantan, Malaysia.

**Introduction:** Laparoscopic anterior resection of rectosigmoid cancer may improve short-term outcome. However only a few study have been done to evaluate the cost benefit of laparoscopic approach. In my study, I compared cost benefit and short-term outcomes of laparoscopic and open anterior resection of rectosigmoid cancer at Hospital University Sains Malaysia. This is the pilot study done at this centre for anterior resection surgery of rectosigmoid cancer.

**Methods:** Between January 2000 and December 2014, a retrospective data of total 115 patients underwent anterior resection either laparoscopic or open technique base on the selection criteria. The data of patients were gained from patient's medical records and entered in a data collection form. The non numerical demographic data analyzed using the Pearson's chi square and the numerical data analysed using



Independent T-test analysis. The primary outcome were shortterm outcome and cost analysis perioperative. Outcome parameters were: postoperative complication, length of hospital stay, surgical oncological margin. Cost-benefit analysis was based on hospital costs. The cost parameters were: length of stay, stapler, general anaesthesia, complication, dressing, intraoperative, post operative and total operative. These comparison involved both arms.

**Results:** The mean age were 58 to 59 year old which the youngest aged 17 year old and the oldest aged 86 year old. No significant different in the gender for both groups of anterior resection (p 0.56). The major ethnic group was Malay in this study with percentage more than 90%. Almost majority of the laparoscopic approach of anterior resection were done in the stage I, II and III of rectosigmoid carcinoma. Meanwhile the open approached distributed almost in the entire stage of diseases (p 0.001).

The laparoscopic or open approach gave no difference in the oncological resection margin outcome (p 0.345). Complication data showed that surgical site infection occurred in 2 patients (1.7%) for laparoscopic anterior resection (LAR) and 3 patients (2.6%) for open anterior resection (OAR). Two patients in the open anterior resection developed major early complication of anastomotic leak . However it was not statistically significant (p 0.333). The mean length of stay (LOS) was 11.41 days (SD, 3.65; range 6 to12 days) in the LAR group and 8.26 days ( SD, 1.22, range 7 to 25) in the OAR group. LAR group recorded shorter hospital stay with mean of 8.3 days while open AR recorded mean of 11.4 days (p 0.001).

Cost analysis showed analytical significant in the LOS cost (p 0.001), intraoperative cost with metal/recycle trocar (p 0.001), total operative cost with

metal/recycle trocar (p 0.001). Meanwhile the remaining parameters were not significant in statistical analysis.

**Conclusions:** Laparoscopic anterior resection in patient with rectal cancer resulted in an earlier postoperative recovery and similar shortterm outcome compare to the open anterior resection. Cost benefit analysis showed reduced charge in laparoscopic group if recycled laparoscopic trocar or usage metal trocar were used. Meanwhile there is a significant additional cost in laparoscopic if usage a new trocar for each operation slots.

Keywords: laparoscopic anterior resection, trocar, post operative cost.

Dr Ikhwan Sani Mohamad : Supervisor

Dr Maya Mazuwin Yahya : Supervisor

# CHAPTER 1

## INTRODUCTION

### 1.1 LITERATURE REVIEW

Colorectal cancer is the third most common cancer worldwide and accounts for nearly 1.4 million new cases and 694,000 deaths per year. Approximately one third of all colorectal cancers are localized in the rectum (Buunen *et al.*, 2009). Less than a half century ago, rectal cancer had a poor prognosis, with cancer recurrence rates in the pelvic or perineal area (locoregional recurrence) of up to 40% and 5-year survival rates after surgical resection of less than 50% (Hüscher *et al.*, 2016). In the 1980s, Heald and Ryall introduced a new surgical technique of complete removal of the fatty envelope surrounding the rectum (mesorectum), called total mesorectal excision. The adoption of total mesorectal excision combined with neoadjuvant chemoradiotherapy in selected patients has reduced locoregional recurrence rates to below 10% and improved cancer-free survival rates to more than 70% (Majbar *et al.*, 2016; Pecorelli *et al.*, 2016).

Laparoscopic surgery has progressively replaced open colonic surgery in recent decades owing to favorable short-term outcomes, such as less pain, reduced blood loss, and improved recovery time (Trépanier *et al.*, 2016). Initially, there was concern regarding the safety of laparoscopic colectomy after reports of cancer recurrence in the abdominal wall (Araujo *et al.*, 2016). In various trials in which patients with colon cancer were randomly assigned to undergo either open or laparoscopic surgery, evidence was obtained that laparoscopic surgery was associated with similar disease-free and overall survival rates as open surgery (Arezzo *et al.*, 2016; Manceau *et al.*, 2016). However, evidence is lacking from large, randomized clinical trials indicating that survival after laparoscopic resection of rectal cancer is

not inferior to open surgery. They previously reported that laparoscopic surgery in patients with rectal cancer was associated with similar surgical safety and improved recovery time, as compared with open surgery (Buunen *et al.*, 2009). In the Colorectal Cancer Laparoscopic or Open Resection (COLOR) II trial, they report the long-term rates of locoregional recurrence and survival in patients who were randomly assigned to undergo one of the two procedures.

The management of colorectal cancer is based on surgical resection of the primary tumor. Few significant alterations in technique have been made over many years. Some improvements have led to benefits in local recurrence and survival, including Heald's work on TME in rectal cancer (Adam *et al.*, 1994). The laparoscopic approach, which was introduced over the last 25 years, has created the potential for a significant change in the technique of colorectal resection (Davies and Larson, 2004)

Laparoscopic surgery has revolutionised some operations, including cholecystectomy and Nissen fundoplication. The first laparoscopic cholecystectomy was performed in 1988 (Dubois *et al.*, 1990) and (Perissat *et al.*, 1990), and this has subsequently become the standard method for the management of gallbladder disease. This operative access is likely to be less costly and more effective than open cholecystectomy for most patients, as long as it does not routinely require preoperative cholangiography and is not associated with increased professional fees or increased risks of retained stones or bile duct injury (Bass *et al.*, 1993).

There are just a few studies that address the cost benefit in the laparoscopic anterior resection and the open anterior resection. A study shows there was additional charged in the laparoscopic group compare to open anterior resection, which was \$1748 per patient randomized (\$1,194 the result of surgical instruments and \$554 the

result of longer operative time). The cost saving in the laparoscopic group was \$1,396 per patient (\$647 the result of shorter hospital stay and \$749 the result of lower postoperative complications). So the net balance resulted in \$351 extra cost per patient randomly allocated to the laparoscopic group (Braga *et al.*, 2005). The cost of laparoscopic resection is more expensive than conventional surgery, because of the longer theatre time and the additional laparoscopic instruments (Leung *et al.*, 2004). The overall short-term cost analysis in CLASSIC trial indicates that the cost of either laparoscopic or open anterior resection were similar although the cost of rectal surgery was slightly higher in laparoscopic group (Franks *et al.*, 2006).

The recent meta-analysis, including 17 non-randomized and 3 RCTs suggested that laparoscopic anterior resection resulted in earlier postoperative recovery compared with open surgery (Aziz *et al.*, 2006). To evaluate whether laparoscopic anterior resection might be associated with potential advantages over open technique in local hospital setting in Malaysia, a retrospective data series at Hospital Universiti Sains Malaysia (HUSM) with short-term outcome and cost analysis are necessary.

The aim of this study is to evaluate short-term postoperative outcome and cost analysis of laparoscopic and open anterior resection performed in our hospital from year 2000 to 2014.

### **1.1.1 OPEN ANTERIOR RESECTION**

A long midline incision is made starting just above the symphysis and extending to the umbilicus and around it on the left side to provide easy access to the splenic flexure. Liver is palpated for possible metastasis, and the location and mobility of the growth as well as the presence or absence of metastatic lymph nodes are verified by palpation. Mobility of the transverse and descending colon is

evaluated with special reference to the adequate exposure of the splenic flexure. Undue traction on the omentum or colon in the region of the spleen may result in troublesome bleeding from a tear in the splenic capsule, hence many surgeons routinely mobilize the splenic flexure.

Lateral mobilization of line of Toldt done to mobilized the sigmoid and descending colon. A high ligation of the inferior mesenteric lymphovascular pedicle is carried out following exposure and clear identification of the left gonadal vein and ureter. The sigmoid artery is ligated near the inferior mesenteric artery with preservation of the arcade between the ascending and descending branches of the left colic artery. The mesentery of the left colon is divided over to the junction of the sigmoid and descending colon

A point on the sigmoid is selected for division, and the mesenteric border is meticulously cleared for a distance of approximately 2 cm. Active pulsations must be present in the mesentery, and the cleared area must be free of diverticuli. A total mesorectal excision carried out to at least 2 cm, preferably 5 cm, below the tumor. A linear stapler is applied across the rectum at that level and the mesorectum is divided and leaving the rectal stump. Rechecked any gaping of the stapler line.

The end of the descending colon opened. A circumferential purse string of 2/0 polypropylene suture is placed. The open end of the descending colon is gently manipulated over the end of the anvil, and the suture is securely tied. The assistant gently dilates the anus and inserts the curved stapler of appropriate diameter. The surgeon assists from above in the passage of the instrument as the spike advances through the rectum, just posterior to the stapled stump.

The adequacy of the previously placed purse-string suture is carefully determined. The completeness of the mucosal closure is rechecked to be certain there

is no gap between the shaft of the purse-string closure. Bulky puckering of excess tissue avoid, failure to compress the tissues adequately will lead to failure of the anastomosis. As the assistant closes the instrument from below, the surgeon from above prevents fatty tissues from being trapped between the bowel ends. The assistant verifies that the stapler is tightened to the correct thickness for the height of its staples as shown by a color-bar indicator in the handle of the stapler. The trigger lock is released and the handles squeezed to fire and create the anastomosis.

After firing of the stapler, carefully release the firing to avoid the possibility of disrupting the line of staples during its removal.

Before closure of the abdomen, the “doughnuts” created by the instrument must be carefully inspected for 360 degree continuity. A gap indicates a possible leak, which will require additional external interrupted sutures. The integrity of the anastomosis is confirmed by filling the pelvis with sterile saline, and air is injected through a catheter or proctoscope in the rectum. The appearance of air bubbles identifies the presence of a leak that must be repaired by interrupted sutures.

Then the abdominal wall closed by layer. Rectus closed by the ethilon loop 2/0. Skin closed by dafilon 3/0 interrupted suture.

### **1.1.2 LAPAROSCOPIC ANTERIOR RESECTION**

Throughout the procedure, the patient is predominantly put in a Lyoid Davis position with right-side-down tilt, a position that helps clear the small bowel off the lower abdomen and pelvis. In the case of a female patient, for better pelvic exposure, we hitch up the uterus to the lower anterior abdominal wall with sutures. We routinely use a 5-ports technique

We use the medial-to-lateral approach. The sigmoid colon is then swung to the left side, the right ureter is outlined, and the retroperitoneum at the base of the sigmoid mesentery is incised, first at the 2cm above level of the sacral promontory. A generous retromesenteric window is then made at the base of the mesosigmoid. Division of the retroperitoneum can safely continue superiorly anterior to the aorta, until the inferior mesenteric artery (IMA) is encountered. The IMA controlled with twice hemolock proximally and divided. The inferior mesenteric vein (IMV) lateral to the artery is likewise divided and hemolock. This mesenteric division is continued for a few centimeters, until it is judged that the vascular pedicle can be delivered to the skin surface without tension. This dissection is continued laterally toward the splenic flexure for as far as possible, until the Gerota's fascia is exposed. The inferior border of the pancreas should now be clearly evident. Caution needs to be exercised to avoid inadvertent injury of the marginal artery and left branch of the middle colic vessels by keeping away from the colon.

Then do the lateral dissection. The lateral peritoneal attachment of the sigmoid (Toldt's fascia) is first divided until continuity to the medial dissection previously. The left ureter is more easily identified in the left lateral peritoneal space, and brings it downward and preserved. A cotton tape, cut to 15–20 cm long, tied around the rectosigmoid junction through a mesenteric window helps facilitate counter-traction by the assistant surgeon.

The left gonadal vessels and medially the left ureter are identified under the retroperitoneum. The retroperitoneum is then incised medial to the left ureter. The presacral space is entered at a plane anterior to the left hypogastric nerve, which is located around 1–2 cm lateral to the midline at the level of the sacral promontory.

The rectum is then retracted upward and forward, and the loose areolar plane



between the mesorectum and the presacral fascia is identified. The right and left hypogastric nerves should be clearly visualized on the presacral fascia as two structures radiating downward and diverging outward in the pelvis. Wide opening of this presacral space is continued posteriorly, respecting the presacral fascia, up to approximately 5 cm distal to the tumor. Laterally, dividing the posterior parietal peritoneum in parallel to the rectum performs the left and right peritoneal dissection. A point 5 cm distal to tumor is then chosen for subsequent rectal transection, and at this level the posterior mesorectum is thinned down, until the rectal tube is exposed. The assistant surgeon now pulls the rectum in a cephaloid direction, and then rectum is transected with a linear endo-stapler introduced in the 12 mm right iliac fossa port. Several firings are sometimes required. An angulations stapler is preferred, especially in lower resections. After this, a trial descent is performed to estimate whether enough length has been obtained for subsequent anastomosis. Provided the sigmoid is healthy with good blood supply, and there is adequate length, splenic flexure takedown is not essential.

Pfannenstiel's incision is then made for the delivery of the specimen with wound retractor. Alternatively, the premarked ileostomy site can be used for specimen extraction if the tumor is not bulky. The purse string devices applied at the distal of descending colon and then divided. The detachable anvil of a circular stapler is then inserted into the apex of the pouch and secured with a 2/0 Prolene purse string suture method. The pouch is put back into the peritoneal cavity. After specimen extraction, pneumoperitoneum is re-established by using a glove and alexis wound coverage. After pneumoperitoneum is re-established, using the circular stapler completes intracorporeal anastomosis. The pelvis is drained using blake drain.

A few data suggest the technique of laparoscopic sphincter-saving TME is

associated with good short and medium-term outcomes (Brouquet and Nordlinger, 2014; Tsang *et al.*, 2003; Tsang *et al.*, 2006) and is oncologically sound (Tsang *et al.*, 2006). These techniques able to achieve a local recurrence rate of 7.4% and an overall 5-year survival of 70%. These data suggest laparoscopic resection for rectal cancer is safe and is the procedure of choice in selected patients (Ng *et al.*, 2009; Tsang *et al.*, 2006).

## **1.2 RATIONALE FOR THE STUDY**

This study is conducted to evaluate short-term outcome and cost analysis of laparoscopic anterior resection compared with open anterior resection for rectosigmoid cancer, and to explore the various factors influencing these outcomes.

## CHAPTER 2

### STUDY PROTOCOL

#### 2.1 INTRODUCTION:

The laparoscopic anterior resection approach for rectal surgery would be expected to have similar benefits as for patients with the colon cancer. However this has been impossible to quantify because of the limited number of RCTs comparing laparoscopic surgery (LPS) versus Open Anterior Resection (OAR).

A major drawback of LPS is the high cost caused by operating room (OR) charges (Abraham *et al.*, 2004). In view of worldwide increasing concerns about exploding cost in medical care, the decision process for adopting new routine treatments should be informed by cost-benefit analyses of clinical trials. Such data is lacking in our environment as there is no local study which has been done regarding of cost analysis in laparoscopic anterior resection for rectosigmoid carcinoma

#### 2.2 LITERATURE REVIEW

Laparoscopic surgery for rectal cancer is still under discussion, but there is evidence that minimal access surgery can be feasible and safe also in this field (Pugliese *et al.*, 2008).

There was no previous trial focused on cost benefit analysis of laparoscopic anterior resection (LAR) in patients with rectal cancer. All studies showed that operation room costs of LAR were substantially higher because of both longer operation and more expensive surgical instruments (Delaney *et al.*, 2003; Lacy *et al.*, 2002).

Patient with rectal cancer were excluded from the majority of RCTs comparing laparoscopic versus open surgery because uncertain oncologic adequacy of laparoscopic approach and the need for a long learning curve and continuous training to perform rectal resection safely (Janson *et al.*, 2004).

A recent metanalysis includes 17 non-randomized and 3 RCTs suggested that laparoscopic resulted in an earlier postoperative recovery compared with open surgery (Aziz *et al.*, 2006).

The laparoscopic surgery allowed an adequate rectal cancer clearance (Davies and Larson, 2004; Morino *et al.*, 2003).

RCTs found that the additional operative room charge in the laparoscopic group was \$1748 per patient randomized (surgical instrument charge + OR occupancy). Sixty five percent patient had an uneventfull postoperative complication. That means cost of routine care was the same in both group (\$360/day) (Braga *et al.*, 2005).

The saving in the LPS group was \$1396 per patient randomized (\$647 result from shorter LOS and \$749 result of lower cost of postoperative complications). However the net balance resulted in \$351 extra cost per patient randomly allocated to the laparoscopic group (Braga *et al.*, 2005).

Short-term postoperative morbidity was similar in the laparoscopic anterior resection (LAR) and open anterior resection. The LAR resection reduced the length of stay (LOS), improved first year quality of life, and slightly increased hospital cost (Braga *et al.*, 2005).

Mean hospital stay was significantly shorter in the LAR versus open anterior resection; 10.7 versus 17.8 days. Mean morphine requirements were less in patients who had laparoscopic anterior resection (LAR) and their recovery was more rapid.

Adequate tumour clearance was achieved in both group. Conclusion the LAR significant early benefit for patient (Psaila *et al.*, 1998).

## **2.3 OBJECTIVES**

### **2.3.1 General Objectives**

To evaluate the cost effectiveness and short- term outcome of the laparoscopic anterior resection compare to the open/ conventional anterior resection of the rectal carcinoma.

### **2.3.2 Specific Objectives**

- a) To compare the mean of the demographic data between both group.
- b) To compare the effectiveness oncological resection, short term outcome and complication, length of stay and operative time of laparoscopic and open anterior resection.
- c) To compare intraoperative cost, postoperative cost and total operative cost of laparoscopic anterior resection with the open anterior resection.

### **2.3.3 Research Questions**

- a) Is there any difference in short term post-operative outcome between laparoscopic and open anterior resection?
- b) Is there any difference in cost of laparoscopic compare to the open anterior resection?

#### **2.3.4 Null Hypothesis**

- a) A tumour stage, oncological resection, operative time, postoperative complication and length of stay are difference between the laparoscopic and open anterior resection group.
- b) There is difference in cost benefit of laparoscopic and open anterior resection in Hospital Universiti Sains Malaysia.

#### **2.3.5 Alternative Hypothesis**

- a) A tumour stage, oncological resection, operative time, postoperative complication and length of stay are no difference between the laparoscopic and open anterior resection.
- b) There is no difference in cost benefit of laparoscopic and open anterior resection in Hospital Universiti Sains Malaysia.

## **2.4 METHODS**

### **2.4.1 Study Design**

This is a retrospective cohort study

### **2.4.2 Study Duration**

This study will be conducted from January 2000 to December 2014 based on retrospective data.

### **2.4.3 Study Location**

This study will be conducted in Hospital Universiti Sains Malaysia (HUSM), Kota Bharu, Kelantan. Hospital Universiti Sains Malaysia is a teaching university hospital under management Ministry of Higher Education, Malaysia located in the centre of Kota Bharu city. This is a tertiary referral center for the whole East Coast Peninsular of Malaysia.

### **2.4.4 Sample Population**

The study includes all patients who have undergone anterior resection from 1st January 2000 to 31st December 2014. List of patients who underwent anterior resection in between January 2000 to December 2014 were obtained from the record in the operation theatre. The data of patients were gained from patient's medical records and the data will be entered in a data collection form.

The data collection started after ethical approval and permission from the Ethical Committee for retrieving the patients' medical records from record office. The patients with missing case notes or incomplete data collection involving the important information were excluded from the study.

The personal medical information were kept confidential. Only the final analysis result were presented or published. The personal medical information may be reviewed by the Ethical review Board for this study, and regulatory authorities for the purpose of verifying the clinical data.

## **2.4.5 Selection Criteria**

### **2.4.5.1 Inclusion Criteria**

All patient undergone elective laparoscopic or open anterior resection in HUSM from January 2000 to December 2014.

### **2.4.5.2 Exclusion Criteria**

- a) Patient underwent emergency anterior resection secondary to intestinal obstruction.
- b) Laparoscopic converted open anterior resection.
- c) Patient not fit for surgery due to multiple medical problems.
- d) Patient for palliative care.

## **2.4.6 Sample Size Determination**

Sample size calculation using PS software.

### **a) Objective 1 : Pearson's Chi Square and independent t-test**

The categorical data using Person's Chi Square. Meanwhile the non categorical data using independent t-test. The sample size was calculated based on specific objectives. For objectives 1, sample size was determined by using power and sample size calculation (PS) software (Dupont and Plummer Jr, 2010).



**b) Objective 2: Independent t-test.**

For objectives 2, sample size was determined by using power and sample size calculation (PS) software (Dupont and Plummer Jr, 2010). The calculation is based on power 80% and significance level ( $\alpha = 0.05$ ).

The minimum sample size required from calculation is 170 patients (Braga *et al.*, 2005). However total number of patient underwent anterior resection for the past 14 years in HUSM were 115 patient. So we take all available patients, keeping in mind that the study might be underpowered.

**2.4.7 Research Tools and Data Collection**

Data collection form (Performa) is design to obtain the information from patient's case record. After ethical approval, a list of patients who underwent anterior resection in between January 2000 to December 2014 were obtained from the record in the operation theater. Patients who fulfil the inclusion criteria were recruited in the study. The data of patients will be obtained by retrospective study of patient's medical records. The data will be entered in a data collection form. Patients will be divided into two groups based on laparoscopic and open anterior resection.

#### 2.4.8 Definitions

- a) Laparoscopic anterior resection in this study is defined as minimal access surgery of anterior resection using the laparoscopic camera, telescope, insufflator, abdominal trocar and wound protector alexis with laparoscopic instrument.
- b) Open anterior resection defined as conventional open method of resection of rectal tumor with approach via the midline laparotomy wound.
- c) Surgical Stapler is medical device which is used to apposed the bowel wall.
  - i) Linear Cutter Stapler<sup>®</sup> / Directional Stapling Technology (DST<sup>®</sup>) stapler from Johnson & Johnson (J&J) company are used for anastomosis the remaining bowel end and close the incision in colonic surgical operation. The device use reload cartridge.
  - ii) Circular Detachable Head (CDH<sup>®</sup>) stapler from J&J Company is used for intraluminal delivery of double staggered rows of staples following a circular pattern. These staplers include a detachable head assembly, a firing handle, a locking spring, a staple housing, and trocars; they are appropriate for use in gastrointestinal tissues (typically from 1 to 2.5 mm thickness). Usually a circular knife cuts a stoma simultaneously to staple driving through the tissues. Circular staplers are available in several sizes to adapt their use to different diameters of the lumen. It is using for primary anastomosis of colorectal.

d) Stage of tumour defined an extend of rectal cancer using the TNM staging and converted to the Modified Astler-Coller (MAC)/ Modified DUKES classification in this study.

**TABLE 1: TNM STAGING OF THE RECTOSIGMOID CANCER RELATED TO DUKES CLASSIFICATION.**

MAC		TNM
A	Tumour invade submucosa	T1N0M0
B1	Tumour Invades muscularis propria	T2N0M0
B2	Tumour invades trhough the muscularis propria/ or surfaces of visceral peritoneum	T3N0M0  T4aN0M0
B3	Tumour invades / adhere adjacent organ or structures.	T4bN0M0
C1	Tumour invade up to the muscularis propria Nodes metastases up to 4 to 6 regional nodes	T1N1M0/ T1N2aM0
C2	Tumour invades visceral peritoneum with metastases >4 or > 7regional nodes	T4aN2aM0/ T3/T4aN2bM0
C3	Tumour invade adjacent structures	T4bN1-N2M0
D	Any T, any N with single or multiple Metastases	TNM1aM1M1b

Early stage were in stage Duke A to B2. Meanwhile the intermediate stage or locally advance stage were in Duke B3 to C3.

- e) Free Margin defined as the tumour border which is free of tumour tissue histopathologically (resection >1cm proximal and distal margin, > 2mm Circmferential Radial Margin;CRM ).
- f) Margin Involved defined as resection positive tumour tissue or closed margin (margin tumor involved less than 1cm proximal and distal, less than 2mm CRM) by histopathological examination.
- g) Complication defined as shorterm morbidity developed post operative of anterior resection before discharge or before 30 days postoperative, includes; surgical site wound infection, prolonged ileus, anastomotic leaked:-
  - i. Surgical site infection defined any surgical incision infection in superficial or deep incisional or organ/space related occurring within 30 days after the operation or 1 year if implant insertion.
  - ii. Prolonged ileus defined in inevitable patient to taken orally more than 3 days.
  - iii. Anastomotic leaked defined as a communication between the intra- and extraluminal compartments owing to a defect of the integrity of the intestinal wall at the anastomosis between the colon and rectum or the colon and anus. The following features were observed: the presence of peritonitis caused by anastomotic dehiscence; the presence of feculent substances and gas from the pelvic drain; or the presence of pelvic abscess with a demonstration of anastomotic leak by rectal examination, sigmoidoscopy, or contrast study (Law *et al.*, 2006; Rahbari *et al.*, 2010).

- h) Length of stay defined the duration in days of patient admitted in ward until discharge home.
- i) Intra-operating time or general anesthesia time defined the time in minutes patient was gave an anaesthesia induction until the extubation of the endotracheal tube in operation theatre (Braga *et al.*, 2005).
- j) Intraoperative equipment defined the equipment used for the anterior resection either in laparoscopic or open method; includes the staplers ( CDH<sup>®</sup>/ Linear Stapler<sup>®</sup>/ DST<sup>®</sup> stapler ), J shape needle vicryl suture, laparoscopic trocar.
- k) Complication cost defined the cost involved in managing the complication included the imaging, dressing and treatment (Braga *et al.*, 2005; *Jabatan Perbendaharaan Hospital Universiti Sains Malaysia.*, 2014).
  - i. CT scan charge RM 400
  - ii. AXR charge RM 35
  - iii. Ultrasound abdomen charge RM 80
  - iv. Medical treatment RM 2.50 per day
- l) LOS cost is defined as the cost of the patient stays in the ward in a day since the admission until discharge home with charge RM3 per day (*Jabatan Perbendaharaan Hospital Universiti Sains Malaysia.*, 2014).
- m) Dressing cost is defined as the charge of the patient dressing in ward with RM 10 per day (*Jabatan Perbendaharaan Hospital Universiti Sains Malaysia.*, 2014).

- n) General anaesthesia cost is defined as the general anaesthesia time cost RM50 / Hour (*Jabatan Perbendaharaan Hospital Universiti Sains Malaysia.*, 2014).
- o) Intraoperative equipment cost is defined as intraoperative cost involved with usage the equipments: stapler, suture and laparoscopic trocar.
- p) Intraoperative cost is defined as the total general anaesthesia cost plus with the intraoperative equipment cost.
- q) Post operative cost include the complication cost and the dressing cost.
- r) Total operative cost defined as all the intraoperative and post operative cost. We calculated and analyzed the total operative cost for laparoscopic approach in the 2 groups; one group with recycle/metal laparoscopic trocar and another group of disposable laparoscopic trocar. Both were compared to the open anterior resection group.

#### **2.4.9 Statistical Analyses**

The data will be analysed using Statistical Package for the Social Sciences (SPSS) software version 22. Pearson's Chi Square and independent T-test will be used to determine the difference. P value of less than 0.05 is considered statistically significant.

At the beginning of the analysis, data was explored, checked and clean. Data exploration was done mainly to acquire the descriptive statistic that describe all the variables and to observe the distribution of the data through graphs and tables were constructed. In addition, it was also essential for checking any missing values as well as wrong data entry.

In this study, mean and standard deviation for age, length of stay (LOS), stapler usage, intraoperative time and all cost involved were obtained. The frequency and percentage were obtained for categorical variables like gender, ethnicity, tumour stage, margin, and post-operative complications.

Independent t-test was applied to determine the difference of mean between groups for variable: LOS, stapler usage intraoperative, Intraoperative time, and all cost analysis. Besides, Pearson Chi Square was performed for difference of proportion between groups. The level of significance was set as 0.05 with two-tailed fashion.

## 2.5 DOCUMENT SUBMITTED TO FOR ETHICAL APPROVAL.



JAWATANKUASA ETIKA PENYELIDIKAN (MANUSIA) - JEPeM  
HUMAN RESEARCH ETHICS COMMITTEE - HREC

### PERMOHONAN KELULUSAN ETIKA (ETHICAL APPROVAL APPLICATION)

(Sila sertakan 3 salinan kertas kerja ini kepada Pusat Inisiatif Penyelidikan Sains Klinikal dan Kesihatan, Universiti Sains Malaysia, Kampus Kesihatan melalui Dekan / Pengarah / Ketua Jabatan di Pusat Pengajian masing-masing)

(Please submit 3 copies of your research proposal to Centre for Research Initiatives Clinical & Health Sciences, Universiti Sains Malaysia, Health Campus through your respected Deans / Head Department)

<b>A.</b>	<b>Tajuk penyelidikan yang dicadangkan:</b> <i>(Sila sertakan versi Bahasa Melayu dan versi Bahasa Inggeris)</i> <i>Title of proposed research</i> <i>(Please put the title in Malay version and English version)</i>		<b>Retrospective Short Term Outcome and Cost Analysis of Laparoscopic Anterior Resection Versus Open Anterior Resection for Rectosigmoid Carcinoma at Hospital University Sains Malaysia.</b>			
	<b>Nama:</b> <i>Name</i>	DR MAZWAN BIN MOHAMAD		<b>No. Kad Pengenalan:</b> <i>Identity Card No.</i>	790105-03-6093	
	<b>Pusat Tanggungjawab [PTJ]:</b> <i>School / Department / Unit</i>		JABATAN SURGERI, PPSP.			
	<b>No. Telefon Pejabat:</b> <i>Office Telephone No.</i>				<b>Alamat E-mel:</b> <i>E-mail Address</i>	<a href="mailto:drmazwan@icloud.com">drmazwan@icloud.com</a>
	<b>Jawatan:</b> <i>Position</i>	MMED( SURGERY)	<b>Gred:</b> <i>Grade</i>	UD48	<b>No. Staf:</b> <i>Staff Number</i>	PUM0397/11
	<b>Tarikh mula berkhidmat dengan Universiti ini:</b> <i>Date of first Appointment to the University:</i>			1 JULY 2011		
	<b>Jika kontrak, nyatakan tarikh tamat:</b> <i>If on contract, state expiry date</i>			-		
	<b>Kumpulan FOR (Field of Research Group)</b> <i>*(Sila rujuk Panduan / Please refer to "Malaysian (R&amp;D) Classification System")</i>			<b>Kumpulan SEO (Socio-Economic Objective Group)</b> <i>*(Sila rujuk Panduan / Please refer to "Malaysian (R&amp;D) Classification System")</i>		



	<b>Kod FOR:</b>	<b>Kod SEO:</b>	
	<b>Tempat penyelidikan dijalankan:</b> <i>Location of research</i>	HOSPITAL UNIVERSITI SAINS MALAYSIA	
	<b>Tempoh projek (tidak melebihi 24 bulan):</b> <i>Duration of project (not more than 24 months)</i>	2015-2016.	

## **2.6 ETHICAL APPROVAL LETTER.**