

Learning Curve in Laparoscopic Colorectal Surgery for Treatment of Neoplasms Using Monopolar Shears

Curva de Aprendizagem em Cirurgia Colorretal Laparoscópica para Tratamento de Neoplasia Utilizando Tesoura Monopolar

JULIANO ALVES FIGUEIREDO¹; RAMON PIRES MARANHÃO²; HÉLIO ANTÔNIO SILVA³; FREDERICO FONSECA CAMPOS⁴; MATHEUS MATA MACHADO M DUQUE ESTRADA MEYER⁵; MARCOS CAMPOS WANDERLEY REIS⁶; ANDY PETROIANU⁷

This study was carried out at the Hospital da Baleia and the Hospital Life Center, Belo Horizonte, MG, Brazil, and the Vespasiano School of Health and Human Ecology, Minas Gerais.

¹. TCBC, TSBCP, TSOBED, Associate Member of SOBRACIL, Master's and Doctorate in Surgery from the Federal University, Minas Gerais (UFMG), Staff Surgeon, Hospital da Baleia, Belo Horizonte, MG, Brazil. julianofigueiredo@ig.com.br; ². Coloproctologist of the Hospital Life Center, Belo Horizonte, MG, Brazil; ³. Fellow of the SBCP, Coloproctologist of the Hospital Life Center, Belo Horizonte, MG, Brazil; ⁴. Medical Student, Vespasiano School of Medicine and Human Ecology (FASEHV); ⁵. General Surgeon and Coloproctologist, Hospital da Baleia, Belo Horizonte, MG, Brazil; ⁶. TCBC, Chief of the General Surgery service of the Hospital da Baleia and of the Hospital Life Center, Belo Horizonte, MG, Brazil; ⁷. TCBC, Full Professor, Department of Surgery, School of Medicine, UFMG; Doctorate in Surgery and Physiology and Pharmacology from UFMG; Livre Docência in Surgery from USP and UNIFESP, CNPq Level 1 Researcher.

ABSTRACT

Introduction: In order to master laparoscopic colorectal surgery is necessary that the surgeon have experience with open colectomies, and previous experience performing smaller laparoscopic procedures. The most widely used instruments for laparoscopic colorectal operations are the ultrasonic shears or bipolar shears. In Brazil these instruments are generally not available in the public health system and not reimbursed by most health insurance plans. The authors studied their own learning curve using monopolar shears. **Objective:** The objective of this study was to evaluate the necessity of use of monopolar shears on laparoscopic procedures and its relation with conversion on the 50 first cases of laparoscopic colorectal surgeries. The procedures included were those involving resection of the colon or the rectum. **Patients and Methods:** We evaluated the first 50 cases of colon or rectal resection performed by a single team of surgeons. We evaluated the rate of conversion of patients undergoing surgery with ultrasonic shears and monopolar shears and the reasons for conversion. **Results:** Ninety two percent of cases were oncologic patients and the total conversion rate was 18%, due to uncontrolled bleeding, difficulty to identify retroperitoneal structures, thick mesocolon and problems with the laparoscopic equipment. The most frequently performed surgery was the high anterior resection. Five conversions occurred with monopolar shears compared with four conversions with ultrasonic shears. **Discussion and conclusion:** The use of monopolar shears was not a determinant factor for conversion to open surgery. After the surgical team has adequate preparation, the learning curve in laparoscopic operations/surgeries of the colon and rectum with monopolar shears had conversion rates similar to those reported in the scientific literature.

Key words: Colon cancer, Laparoscopy, Rectal cancer, Colectomy.

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INTRODUCTION

The benefits of laparoscopic colorectal surgery include less postoperative discomfort, shorter hospital stay, and better abdominal cosmetic results.¹ On the other hand, the operative time is longer and

requires special preparation in order for the surgeon to be adequately trained to perform this procedure. The costs of laparoscopic surgery are higher than laparotomy.

Advanced laparoscopic procedures require the ability to identify and dissect anatomical planes

without tactile perception and under conditions where the surgeon's ability to control bleeding is constrained. Besides these factors, the surgeon has to operate in multiple quadrants of the abdomen and often reconstruct the intestinal transit after resection of the colon or rectum.²

The indications for laparoscopic colorectal operations have expanded in recent years to the point where there are few differences with open procedures to treat cancers of the colon.^{3,4}

Since 2004, as it has demonstrated good oncological results, laparoscopic colorectal surgery has gained momentum. Surgeons who switch to the laparoscopic approach undergo a learning curve and experience the limitations of the surgical team, of this type of surgical access, and observe complications that lead to conversion to open surgery.¹

The instruments used in laparoscopic surgeries as vessel sealers are bipolar electrothermic shears and ultrasonic coagulating shears.⁵ Monopolar shears cauterize small blood vessels, but are not appropriate to contain the bleeding of larger caliber vessels, so it is necessary to use metal clips for this purpose. The monopolar shears have the additional disadvantage of not securing the structures during dissection. Nevertheless, in our institutions, teams of surgeons who had the opportunity to use the laparoscopic approach, usually chose to perform it using monopolar shears when the coagulating forceps or bipolar shears were not available. The authors found no articles in the scientific literature that discussed the learning curve and its relation to use of monopolar laparoscopic shears.

This study examined the rate of and the reasons that lead to the conversion of laparoscopic to open colorectal surgeries among the first 50 cases performed by a single team of surgeons. The aim of this study was to evaluate whether there were more conversions in the first fifty cases of laparoscopic surgeries of the colon and rectum using monopolar shears.

METHODS

Were retrospectively evaluated the first fifty consecutive patients operated laparoscopically for colorectal disease by a single team of surgeons, during the period from August 2006 to August 2009. Data were drawn from a database maintained by the surgical team. Only patients who underwent resection

of the colon or rectum were included in the analysis. Patients who underwent urgent surgery, were obese with a BMI > 34, or pregnant women were excluded. All explanations provided to patients followed the ethical standards as determined by the participating hospitals.

Conversions to laparotomy were evaluated as to their cause and the operative time when the conversion occurred. All team members had experience in laparoscopic cholecystectomies and appendectomies, and several had "hands on" training courses performing laparoscopic colon surgeries on animals. All of the team's surgeons had observed laparoscopic operations of the colon and rectum in centers with experienced surgeons. The team's two principal surgeons performed more than 40 resections of the colon or rectum per year.

The bowel prep used most often (22% of cases) was a combination of one liter of mannitol, followed by one liter of polyethylene glycol (PEG). Other preparations were also used, however about ten patients did not have oral mechanical preparation, but rather only a clear liquid diet started one day prior to surgery (20% of patients) and a glycerin enema on the eve of the surgery. All patients received antibiotic prophylaxis with ceftriaxone and metronidazole intra-operatively and during the first 24 hours post-operatively.

We considered conversions those circumstances in which it was necessary to abandon the laparoscopic approach, for whatever reason the surgical team deemed necessary, including the need to make an incision larger than that necessary to withdraw the surgical specimen.⁶ Most of the anastomoses were performed extracorporeally, by means of an auxiliary incision on the operated side of the intestine. The right colon was removed through a median longitudinal umbilical incision. The left colon was removed through a transverse suprapubic incision.

RESULTS

The study subjects ranged in age from 24 to 86 years. The frequency distribution of the Body Mass Index (BMI) was: $d' 25$ to (24% of the patients), 26 to 29 (44%) and 30 to 33 (32%). Colon cancer was the indication for surgery in 92% of patients. The frequency distributions of disease type and type of surgery are presented in Table 1.

Table 1 - Frequency of colorectal disease, number of patients operated and type of surgery performed in the first 50 cases.

Disease	Number of patients (%)	Surgery performed (%)
Rectal tumor	12 (24%)	HAR = 8 (16%) Pelvic exenteration = 1 (2%) LAR = 3 (6%)
Tumor of the descending or sigmoid colon	13 (26%)	HAR = 13 (26%)
Polyps that were unresectable by colonoscopy	9 (18%)	Right colectomy = 5 (10%) HAR = 4 (8%)
Tumor of the cecum or ascending colon	5 (10%)	Right colectomy = 5 (10%)
Subepithelial lesion of the colon or rectum	4 (8%)	Right colectomy 3 (6%) LAR = 1 (2%)
Chagas Megacolon	3 (6%)	HAR = 3 (6%)
Familial Adenomatous Polyposis	2 (4%)	Total proctocolectomy with ileal reservoir = 2 (4%)
Tumor of the transverse colon	1 (2%)	Right colectomy = 1 (2%)
Colonic inertia	1 (2%)	Total colectomy = 1 (2%)

HAR – high anterior resection, LAR – low anterior resection.

The most common operations were rectosigmoidectomy and right colectomy (Table 1). For the vascular control, size 400 clips were used preferentially. Monopolar shears were used for surgical dissection in 58% of the surgeries and coagulating shears were used in 42% of cases. Monopolar shears were used whenever the health plan did not authorize the use of ultrasonic coagulating shears.

The quickest operation was a right colectomy that took 150 minutes (2.5 hours) and the longest was a pelvic exenteration with ureterocolonic anastomosis performed extracorporally, that took 450 minutes (7.5 hours). Most tumors invaded up to the intestinal serosa.

Histopathologic examination revealed the presence of four to 18 lymph positive nodes in the surgical specimens. Five patients had liver metastasis or peritoneal implants, but as they were few in number, patients underwent colorectal surgery, and were then referred to the oncology service.

Nine patients had their laparoscopic operation converted to laparotomy. The surgeries in which the conversions occurred included four low anterior resections and two high anterior resections, two right colectomies, and one total colectomy (Table 2). Monopolar shears were used in five of the converted cases, while coagulating ultrasonic shears were used in four. The causes that led to conversion were

Table 2 - Type of surgery performed, problem that lead to the conversion, type of shears used in the surgery/operation, number of cases converted to laparotomy.

Surgery	Problem Precipitating Conversion	Shears used	Number of patients
Right colectomy	Equipment (optic)	Monopolar	1
High anterior resection	Bleeding from the splenic flexure	Monopolar	1
High anterior resection	Lesion in the third segment of the duodenum	Monopolar	1
Low anterior resection	Equipment (insufflator)	Monopolar	1
Low anterior resection	Large rectal tumor	Monopolar	1
Right colectomy	Adhesions near the duodenum	Ultrasonic	1
Low anterior resection	Equipment (Light source)	Ultrasonic	1
Low anterior resection	Bleeding from the splenic flexure and the mid-mesorectum	Ultrasonic	1
Total colectomy	Bleeding from the splenic flexure	Ultrasonic	1

problems with laparoscopic equipment (3 cases), bleeding at the splenic flexure that could not be controlled laparoscopically (3 cases), lesions of the third portion of the duodenum (1 case), an inability to identify the left ureter (1 case), dense adhesions secondary to previous surgeries (1 case), and a bulky rectal tumor (1 case), that was difficult to handle. In these nine cases, the mean time elapsed from the onset of the laparoscopic surgery to conversion to laparotomy was 127 + 65 minutes.

DISCUSSION

The laparoscopic colorectal procedures included various types of resections, involving two or more abdominal quadrants, control of large caliber vessels, identification of extraperitoneal structures such as ureters and gonadal vessels, as well as the need for reconstruction of intestinal transit. The training of a surgeon to perform laparoscopic colorectal surgeries can be considered a learning curve.^{i,7}

Several publications have shown that with experience the surgical team can reduce operative time, the conversion rate, and complications.⁸⁸⁻ Bennett CL, Stryker Sj, Ferreira MR, Adams J, Beart RwJr. The learning curve for laparoscopic colorectal surgery: preliminary results from a prospective analysis of 1194 laparoscopic-assisted colectomies. *Arch Surg* 1997; 132(1): 41-4.^{9,10}

The minimum number of cases for the initial learning of the laparoscopic operation, according to different authors, ranges from 20 to 100 cases.

Conversion to open surgery can be defined as a situation where you cannot complete through the laparoscopic approach that which was planned.^{i,iii} Conversion can also be defined as the moment when an incision larger than that required to withdraw the surgical specimen is made in order to treat an operative complication or to perform part of the dissection.^{xi} Such situations are not reported in some articles, such as type of incision used to remove the surgical specimen.ⁱⁱⁱ The cited rates of conversion from laparoscopy to laparotomy range from 7% and 25%, but there are differences when the case series has a small or a large number of cases.^{ix,11,12}

In a prospective randomized trial called CLASSIC, the conversion rate decreased from 38% in the first year of the study to 16% after six years.¹³ Although conversion itself is not considered a complication, but rather an act of prudence, it can

be associated with a higher postoperative morbidity,^{xiv} depending on the situation that led to the conversion.

Increased Body Mass Index (BMI), tumors larger than 10 cm, adhesions, phlegmon of diverticular disease, inflammatory mass secondary to Crohn's disease, tumors located near the anal margin, tumors invading neighboring organs, and limited experience of the surgeon are cited as factors associated with conversion.

Reviewing the videos of operations is an interesting measure to develop surgical skill.ⁱ In addition, the surgeon's training in laparoscopic appendectomies and cholecystectomies appears to attenuate the difficulties in the learning curve for laparoscopic colorectal procedures.^{vii} The literature shows that there is no ideal method for training the surgeon in laparoscopy. The most common methods are to study recorded videos, use laparoscopic training boxes or other simulators, operate on laboratory animals, watch live operations, and be guided by a more experienced surgeon.^{xii}

Several instruments are used in laparoscopic colorectal surgeries. In addition to varied sources of energy, the most common in our environment are the monopolar shears, bipolar forceps, and ultrasonic coagulating forceps. The last two are the safest, as they produce a small area of burn along the cauterized structure,¹⁴ allow shorter operative time, less bleeding per operation, and use fewer clips.^{15,16,17,18} One of the disadvantages of the operation with the ultrasonic coagulating and bipolar forceps is the higher cost,¹⁹ though this is offset by the advantages enumerated above.

The monopolar shears requires that the surgeon seeks an anatomical dissection and prevent bleeding when possible, since there is no recourse of clamping, as well as the cutting and coagulation features that the ultrasonic and bipolar forceps offer. Furthermore it is often necessary to use metal clips to control bleeding from mesenteric or epiploic vessels. The surgeon gradually adapts to the fact monopolar shears, when triggered, produce heat in the metal tip, and it is prudent not to manipulate bowel loops immediately after triggering these shears. Because they are reused, monopolar shears do not represent an additional cost of the procedure.

In this study it was noteworthy that in six cases of conversion during from high and low anterior resection, there was mobilization of the splenic flexure.

According to the surgeons, the most common critical juncture of the surgery was the difficulty in releasing the splenic flexure. Other challenging moments in the learning curve were releasing adhesions, release of retroperitoneal fibrosis, and the identification of the inferior mesenteric vessels in thick mesocolon. This study suggested it is possible to advance along the learning curve using the monopolar shears when coagulating or bipolar forceps are not available. Good judgment about the limits of the surgical team is important. Similarly selecting surgical candidates that are not so obese and those with less bulky tumors is prudent when initiating the learning curve.

CONCLUSION

After adequate training of the surgical team, using monopolar shears in selected patients did not increase the rate of conversion to laparotomy, even while the surgical team was on the learning curve for laparoscopic colorectal surgeries.

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RESUMO

Introdução: Para a boa aprendizagem da operação laparoscópica colorretal é necessário que o cirurgião tenha experiência com a colectomia por via aberta, além de ter previamente realizado procedimentos laparoscópicos de menor porte. Os instrumentos mais utilizados para cirurgias colorretais laparoscópicas são as tesouras ultrassônicas e tesouras bipolares. Como em nosso país este equipamento não esteve disponível para a utilização no sistema público de saúde e não está reembolsada por operadoras de plano de saúde, os autores estudaram a própria curva de aprendizagem com utilização de tesoura monopolar. **Objetivo:** O objetivo deste trabalho foi avaliar, se o uso de tesoura monopolar, influencia na taxa de conversão nos primeiros 50 casos de operação laparoscópica colorretal. Foram consideradas operações em que houve ressecção de segmento do cólon ou reto. **Pacientes e Métodos:** Avaliaram-se os 50 primeiros casos de ressecção de cólon ou reto realizados por equipe única de cirurgiões. Avaliou-se o índice de conversão dos pacientes submetidos a operação com tesoura monopolar e tesoura ultrassônica e os motivos da conversão. **Resultados:** Noventa e dois por cento dos pacientes tiveram câncer intestinal e o índice de conversão total foi 18%, por sangramento não controlado, não identificação de estrutura retroperitoneal, mesocólon espesso e problemas com o equipamento da laparoscopia. A operação mais realizada foi a ressecção anterior alta. Houve cinco conversões nas operações em que foi utilizada tesoura monopolar e quatro conversões com a tesoura coaguladora ultrassônica. **Discussão e Conclusão:** O uso de tesoura monopolar não foi determinante na conversão para operação aberta. Após a equipe cirúrgica passar por preparo adequado, a curva de aprendizagem em operação laparoscópica do cólon e reto com tesoura monopolar teve índice de conversão semelhante aos apontados pela literatura científica.

Palavras chave: Câncer de colon. Laparoscopia. Câncer retal. Colectomia.

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