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Clinical outcomes of 154 hand-assisted laparoscopic surgeries for left sided colon and rectal cancer: single center experience

Ranka asistuojamų 154 laparoskopinių kolektomijų dėl kairės pusės storosios ir tiesiosios žarnos vėžio rezultatai: vieno centro patirtis

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Background / objective

HALS technique has provided all the benefits of a minimal invasive surgery, is a safe and effective procedure. Our study was aimed to describe characteristics of patients admitted to Institute of Oncology, Vilnius University due to left sided colon and rectal cancer for hand-assisted laparoscopic surgery (HALS), colorectal resections performed, intraoperative, postoperative, incision and trocar site long-term clinical outcomes.

Laparoscopic colectomy is avoided because of its technical difficulty, steep learning curve, and increased operative times. Hand-assisted laparoscopic colectomy is an alternative technique that addresses these problems while preserving the short-term benefits of laparoscopic colectomy. Our study was aimed to describe characteristics of patients admitted due to left sided colon and rectal cancer for hand-assisted laparoscopic surgery (HALS), colorectal resections performed, intraoperative, postoperative, incision and trocar site long-term clinical outcomes.

Methods

A prospectively maintained database was used to identify all patients who underwent HALS for left sided colon and rectal cancer at the Institute of Oncology, Vilnius University, from July 1, 2009, when HALS using transumbilical handport incision was started, to October 1, 2013.

Results

154 HALS colorectal resections were performed. The patients' mean age was 63±11 years. There were 79 male and 75 female patients. BMI was 27.3 ± 5.8 kg/m^2. Forty-four patients (28.5%) have experienced a prior abdominal surgery. The mean HALS time is 105 minutes (55–185). Conversion rate was 3.2% (5/154). The average number of lymph nodes harvested was 15

(3–49). The median of return of gastrointestinal function was 2.5 days (2.2–4.5). The median length of hospital stay was 6.8 days (3 – 31). Postoperative complication rate was 9.7%. Two patients (1.3%) demanded explorative laparotomy. Postoperative mortality rate was 0.65%. There were 4 (2.6%) incisional hernias seen on a mean follow-up of 7.0±3.4 months.

Conclusions: HALS technique has provided all the benefits of a minimal invasive surgery. HALS colorectal resection is a safe and effective procedure.

Keywords: Hand assisted laparoscopic surgery (HALS); Laparoscopic colectomy; Outcomes

Įvadas/ tikslas

HALS technika apima visus minimaliai invazyvios chirurgijos privalumus, yra saugi ir efektyvi. Šioje studijoje prospektyviai nagrinėjama pacientų, kuriems dėl kairės pusės storosios ar tiesiosios žarnos vėžio Vilniaus universiteto Onkologijos institute buvo atlikta ranka asistuojama laparoskopinė kolektomija (HALS), demografiniai rodikliai, procedūros pobūdis, intraoperaciniai ir pooperaciniai duomenys.

Pasaulyje kas dešimta kolektomija atliekama laparoskopiškai. Laparoskopija nėra dažna dėl techninių sunkumų, ilgos mokymosi kreivės, ilgesnės operacijos trukmės. Ranka asistuojama laparoskopinė kolektomija minėtų trūkumų neturi.

Ligoniai ir metodai

Prospektyviai buvo išanalizuotas 154 pacientas, kuriam 2009 07 01 – 2013 10 01 metais Vilniaus universiteto Onkologijos institute buvo atlikta HALS operacija dėl kairės pusės storosios ar tiesiosos žarnos vėžio.

Rezultatai

Atlikta 154 HALS kolorektalinės rezekcijos. Pacientų amžius – 63±11 metai. Operuota 79 vyrai ir 75 moterys. KMI buvo 27,3 ± 5,8 kg/m^2. 44 pacientams (28,6 %), anamnezės duomenimis, buvo atliktos pilvo operacijos. Vidutinė operacijos trukmė – 105 minutės (55–185). Konversijų dažnis – 3,2 % (5/154). Vidutinis pašalintų limfmazgių skaičius buvo 15 (3–49). Gastrointestinė funkcija atsitaisė per 2,5 dienos (2,2–4,5). Pooperacinio periodo trukmė – 6,8 dienos (3–31). 9,7 % atvejų pasitaikė komplikacijų. Dviem pacientams (1,3 %) atlikta relaparotomija. Pooperacinio mirtingumo dažnis buvo 0,65 %. Keturiems pacientams (2,6 %) diagnozuotos pooperacinės išvaržos (stebėjimo vidurkis 7,0±3,4 mėn.).

Išvados

HALS technika apima visus minimaliai invazyvios chirurgijos privalumus, yra saugi ir efektyvi.

Reikšminiai žodžiai: Ranka asistuojama laparoskopinė chirurgija (HALS), laparoskopinė kolektomija, baigtys.

Introduction

Laparoscopic colectomy (LAC) was first reported by Jacobs and colleagues in 1991 [1]. Numerous comparative studies of LAC vs open colectomy for both benign and malignant conditions have demonstrated many short-term clinical benefits of LAC, including less postoperative pain, fewer wound and pulmonary complications, decreased need for blood transfusion, faster return of bowel function, and decreased length of hospital stay [2-3]. It is noteworthy that randomized controlled trials have shown equivalent oncologic outcomes [4].

Despite having all the benefits of laparoscopic surgery, adoption to LAC has been relatively slow. It was estimated that LAC accounted for only less than 10% of colectomies [5]. The adaptation of the laparoscopic approach has not been as rapid for colectomy as it was for cholecystectomy because laparoscopic colon surgery is associated with a steep learning curve because of the need to work in all four abdominal quadrants on a mobile target, to expose (and ligate) substantial vascular structures, and the possible challenge of intracorporeal anastomosis [6]. The estimated learning curve is between 25 and 60 cases, depending on the level of complexity [7]. For the majority of general surgeons, that number of colectomies would equal or exceed their annual colectomy volume.

Hand-assisted laparoscopic surgery (HALS) is a technique that developed soon after the introduction of general laparoscopic surgery -- that is, in the mid-1990s [8]. Although this technique was met by fierce resistance by the laparoscopic community, it is now gaining

the popularity as an adjunct and a bridge towards total laparoscopic colorectal surgery [9]. It seemingly bridges the gap between open and LAC and that might widen the appeal of benefits of laparoscopic surgery by rendering the procedure easier to perform. This is because a porthole-like device is inserted in the abdominal wall which allows the surgeon's hand to be placed into the abdominal cavity while preserving pneumoperitoneum. The surgeon's hand, therefore, can work in concert with standard laparoscopic cameras and instrumentation, to palpate intraabdominal structures, to assist in dissection, retraction, and control of bleeding. This means that the surgeon's hand, placed intraabdominally, facilitates the operation, thereby increasing the ease and speed. The 6 to 7 cm long hand port serves as the extraction site for the specimen.

The study was aimed to describe characteristics of patients admitted due to left sided colon and rectal cancer for HALS in a single institution, colorectal resections performed, intraoperative, postoperative, and HALS incision and trocar site long-term clinical outcomes. The prospects for HALS are discussed.

Methods

This study was a retrospective analysis of prospectively collected data in a single tertiary care institution. A prospectively maintained database was used to identify all patients who underwent HALS for left sided colon and rectal cancer at the Institute of Oncology, Vilnius University, from July 1, 2009, when HALS using transumbilical hand port incision was started, to October 1, 2013. All consented patients were aged 18 years or older with histologically confirmed invasive cancer of descending colon, sigmoid colon as well as upper and middle rectum were included in this study. There was a single exclusion criterion – carcinoma in situ. The following variables were included into the final HALS database: age, sex, body mass index, comorbidities, cancer location and stage, prior abdominal surgery, the operation performed, operative time, estimated blood loss, intraoperative complication, conversion, time of return of gastrointestinal function, length of hospital stay, postoperative complication within 30 days, and up to 30 months HALS incision and trocar sites follow-up outcomes.

Conversion to an open procedure was defined as lengthening of the handport incision more than what was originally planned in order to perform the procedure. *Length of hospital stay* was defined as the number of nights the patient spent from the day of surgery. *Return of gastrointestinal function* was defined as the postoperative day when the patient tolerated soft diet and passed stool.

Surgical Technique

HALS was performed in a standardized manner. Under general anesthesia with the patient in a supine horizontal position with legs outstretched, body fixed to the operating table and operator standing between the outstretched legs, a 6 – 6.5 cm long trans-umbilical incision is performed for the *Dextrus Endopath* (*Ethicon Endo-surgery, LLC, Puerto Rico 00969, USA*) handport device insertion. The HALS resection was accomplished with this hand port and three additional ports. The locations of three trocars were standard – 10 and 12 mm trocars on the right and one 5 mm trocar on the left side (Figure 1).

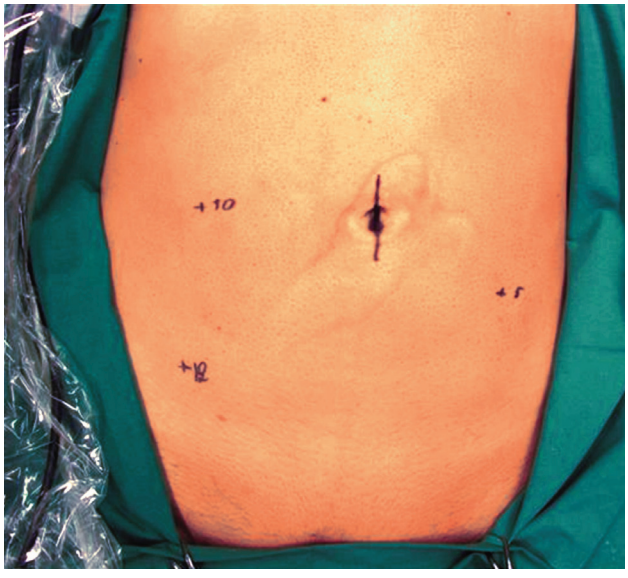

Figure 1. Location of troacars.

A 6 – 6.5 cm long trans-umbilical incision for the *Dextrus Endopath* handport device insertion and standard locations of three trocars – 10 and 12 mm trocars on the right and one 5 mm trocar on the left side of the abdominal wall

Mobilization begins with the descending colon moving upwards to splenic flexure and left side of transverse colon, using hand and harmonic scalpel. After this part, the mobilization continues with the sigmoid colon, then lifting the rectosigmoid at the level of promontorium with superior rectal vessels. Continuous visualization of the left ureter is the critical part of the dissection. Then the inferior mesenteric artery is mobilized and ligated using titanium 10 mm clips 1–2 cm from the aorta, and continuing mobilization of the inferior mesenteric vein and ligating it at the level of the ligament of Treitz. The specimen is divided using an endoscopic linear stapler at the level of the promontorium for the left hemicolectomy or sigmoidectomy, and dividing it 5 cm below the lower edge of the tumor in the mesorectal excision for upper or middle rectal cancer. The specimen is removed through the handport incision, and further anastomosis is performed laparoscopically using a double stapling technique, making a water–air leak test and examining the rings from the stapler for integrity. A drain was routinely placed only after anterior rectal resections with mesorectal excision, and removed on postoperative day 2 to 5. Fascia was closed at the level of 12 mm trocar with single interrupted suture, and hand port – with running PDS 0 suture. Skin incisions are closed with interrupted sutures.

Statistics

Data were entered, calculated and analyzed in Microsoft Office Excel 2007. We report most analyses as simple descriptive statistics with standard deviation unless otherwise specified. The operative time trend was explored from a scatter chart. This project was approved by the Vilnius Oncology Institute Review Board.

Results

Characteristics

Over a 51-month period, 154 HALS colorectal resections were performed. Overall, the patients' average age was 63±11 years (range, 32 – 89). There were 79 male and 75 female patients. The mean body mass index was 27.3 ± 5.8 kg/m^2 (range 22 – 36). 104 patients (67.5%) had comorbidities: 91 of them (87.5%) – cardiac, 13 – pulmonary, 11 – diabetes, 4 – renal, and 8 patients had other various comorbidities; however, the majority of patients (72.8%) were designated as ASA class 1 or 2. Forty-four patients (28.6%) had experienced a prior abdominal surgery.

Diagnosis

All patients had invasive left sided colon or rectal cancer. Diagnoses included, in descending order, sigmoid colon cancer for 74 patients (48.1%), upper rectal cancer for 65 patients (42.2%), descending colon cancer for ten patients (6.5%), middle rectal cancer for four patients (2.6%), and colon splenic flexure cancer for one patient (0.6%). Stage I cancer was confirmed for 55 patients (35.7%), stage II – for 40 (26%), stage III – for 49 (31.8%), and stage IV – for 10 (6.5%).

HALS procedures

The procedures performed are shown in Table 1. Anterior rectal resections with partial mesorectal excision were performed when cancers in the rectum were above 12 cm from the dentate line. Low anterior rectal resections with total mesorectal excision were performed for middle rectal cancer. One subtotal colectomy with ileorectal anastomosis was performed due to sigmoid cancer and familial adenomatous polyposis, and another two subtotal colectomies were performed due to descending colon cancer and multiple polyps in transverse and right colon. Two patients underwent HALS sigmoid colectomy 9 and 10 days, respectively, after laparoscopic sigmoid colotomy and polypectomy for large sigmoid adenomas with high-grade dysplasia which in surgical specimen histology turned out to be T1 sigmoid colon cancer; none had residual or lymph-node disease in final pathology.

Intraoperative outcomes

They are shown in Table 2. It is noteworthy to mention that the mean HALS time is 105 minutes. There was one episode of significant intraoperative bleeding from mesenteric vessels due to inoperative suturing device. There was a positive air-leak test in two patients (1.3%), and interrupted 3.0 vicryl sutures were additionally used to secure the anastomosis. Conversion rate was 3.2% (5/154). The average number of lymph nodes harvested was 15, with the maximum number of 49.

Table 1. HALS procedures performed in 154 patients

HALS procedure	Number	Percent (%)
Anterior rectal resection with partial mesorectal excision	62	40.26
Left hemicolectomy	56	36.36
Sigmoid colectomy	29	18.83
Anterior rectal resections with total mesorectal excision	4	2.6
Subtotal colectomy	3	1.95

Table 2. Intraoperative outcomes and cancer staging: 154 hand-assisted laparoscopic surgeries for left sided colon and rectal cancer

Variables	Value	Range / Rate
Operative time (minutes, mean)	105	55–185
Estimated blood loss (mL, mean)	220	60–1500
Intraoperative complication*	2	1.3%
Conversion	5	3.2%
Due to massive adhesions	2	1.3%
Due to penetrating T4 cancer	1	0.65%
Due to unexpected cancer location**	1	0.65%
Due to massive bleeding from mesenteric vessels***	1	0.65%
Average length of specimen, cm	19.5	8–95
The average lymph nodes harvested	15	3–49

* sigmorectal anastomotic defect in a staple line following anterior rectal resection was observed and proved by air-leak test; defect closed by interrupted single layer sutures.

** preoperative diagnosis was descending colon cancer; however cancer was found in splenic flexure

*** due to inoperative suturing device

Postoperative period outcomes

The median of return of gastrointestinal function was 2.5 days (range, 2.2–4.5). The median length of hospital stay was 6.8 days (3–31). Postoperative complication rate was 9.7% (15 patients). Two patients (1.3%) demanded explorative laparotomy. Postoperative mortality rate was 0.7% (one death). A 78 year old male patient who underwent partial mesorectal excision for stage III upper rectal cancer died because of septic pneumonia on 7th postoperative day. Postoperative complication following HALS and its consequences are shown in Table 3.

HALS incision and trocar sites follow-up

There were 4 (3.9%) incisional hernias seen on a mean follow-up of 7.0 ± 3.4 (range, 2 – 30) months. None of the patients had trocar or hand-port site recurrence.

Discussion

The indications of HALS have been extended successfully for a broad range of disease. Although used for all types of colectomies, segmental colectomies represented the most common procedure with a significant percentage being left sided or rectal resections [10]. As our institution is a tertiary oncological center, most of our HALS cases are operated due to cancer. The patients with descending colon, sigmoid and upper rectal cancer, are ideal candidates for this technique. This is attributed to the fact that left sided colonic cancers are more common than right sided ones in our catchment area. Furthermore, most right sided tumors are dealt with by general surgeons in nearby secondary general hospitals, while left sided and especially rectal cancer are usually referred to our institution for management. Although in the literature, HALS is used for right

Table 3. Primary HALS and postoperative complication

Primary operation	Complication	Patients	Rate (%)	Management	Outcome
Anterior rectal resection* with PME**	Anastomotic leak	1	0.65	Laparotomy, washout, loop ileostomy	Recovered
Left hemicolectomy	Paracolic abscess ***	1	0.65	Laparotomy, washout, loop ileostomy	Recovered
Left hemicolectomy	Pneumonia	1	0.65	Conservatvie	Recovered
ARR with PME	Intraabdominal abscess	1	0.65	Drainage	Recovered
Left hemicolectomy	Urinary retention	1	0.65	Conservative	Recovered
ARR with PME		2	1.3	Suprapubic catheter	Recovered
ARR with PME ARR with PME	Dysuria	1	0.65	Conservative	Recovered
	Bleeding from the anastomotic line	1	0.66	Conservative	Recovered
Subtotal colectomy	Stroke	1	0.65	Conservative	Recovered
ARR with PME	Myocardial infarction	1	0.65	Conservative	Recovered
Left hemicolectomy	Subacute intestinal obstruction	3	2	Conservative	Recovered
ARR with PME: conversion to open	Septic pneumonia	1	0.65	Conservative	Died

* Anterior rectal resection – ARR. **PME – partial mesorectal excision. ***Due to perforation above the anastomotic line

hemicolectomy, we do not use this approach for right hemicolectomy, as we do not see much advantage there since anastomosis is done extracorporeal after right hemicolectomy.

With increasing experience, we performed HALS for more complex colon procedures, including subtotal colectomies with ileorectal anastomosis. It is important to emphasize that the mean operative time was only 105 minutes in our series (range, 55 – 270). And, the trend of the operative time was almost horizontal, suggesting that HALS colorectal resections for left sided large bowel cancer is not a big technical challenge for surgeons who are quite familiar with general colorectal surgery techniques and have had general laparoscopic training [11]. On the other hand, we feel that HALS operating times decreased in the year 2012 – 2013 without any negative consequences. And this decrease would be similar to those of others who have reported decreased operative times for HALS [11, 12] compared with LAC, while maintaining much of the short-term outcome benefits and morbidity as compared with LAC [13-15]. It should be noted that as only 4 patients with middle rectal cancer were included in these series, our experience allows us to emphasize that this surgical technique is indicated for left sided colonic and upper rectal cancer.

When comparing the short-term patient outcomes of HALS colectomy and LAC, they are similar [2, 16]. However, the conversion rate is a less suitable variable for a HALS analysis, as conversion is required infrequently. The conversion rate in our study (3.2%) is less in comparison to the 3-12% conversion rate reported in other studies [16, 17].

We also found in this study that our postoperative complication rate is similar to those published in the HALS studies and is comparable to the reported LAC experience [16-18]. However, there were significant differences between the HALS and LAC, including decreased operative times and fewer converted procedures in the HALS cases. In a multicenter, prospective, randomized trial comparing HALS and LAC for left sided segmental and total colectomies, there were significant reductions in operative times for both segmental and total colectomies in favor of HALS [19].

In our series, the HALS device was inserted in the midline because the mobilized colon is a midline structure. It also keeps the lateral abdomen free of incisions

should an ostomy ever become an issue, and it allows for easy conversion to an open procedure if necessary. In fact, most of the conversions in this study only required a small extension of the HALS incision.

The cost of a new technology needs to be considered in the current health care system. The economic consideration of LAC and HALS colectomy has been analysed in various studies [20, 21]. In a comparative study of 100 HALS colectomies to LAC it was demonstrated that, although the costs of operating room supplies were higher in the HALS cases, there was no difference in the hospitalization costs [20]. In most institutions where operating room costs are allocated in fractions of an hour, a 30- to 60-minute decrease in operating time could represent a significant financial savings for institutions.

There was no trocar site or HAL incision site recurrence in any of our patients. Although trocar site recurrence would be a concern [22], a recent prospective study comparing laparoscopic with open colectomy for cancer does not show any difference in survival between the two groups [23], and a randomized multi-center trial demonstrated oncological noninferiority for the laparoscopic approach [4]. Most HAL devices function as a wound protector which should theoretically protect the HAL wound from tumor implantation.

The long term complication of HALS has been the center of recent debate. It has been postulated that a continuous and persistent stretch of the port site may predispose to the development of incisional hernia. Furthermore, placement of hand in the abdomen in HALS increases the risk of postoperative ileus and the development of intraabdominal adhesions with a future risk of small bowel obstruction [24]. In our series, with a follow-up to 30 months, an incisional hernia was confirmed to 3.9% of patients. There were three patients with subacute intestinal obstruction following left hemicolectomy (2%) within 30 postoperative days. However, there were no patients with small bowel obstruction afterwards.

In summary, this study of a diverse colorectal practice of for more than four years, provides insight into the applicability and outcome of HALS to colorectal resections. The HALS approach to left sided colonic and upper rectal cancer is safe and effective, and has outcomes similar to published data for laparoscopic colorectal surgery. In the present series no obvious drawbacks for HALS colorectal surgery have been identified. For a quality-related outcome, there was no learning curve for this study. Rather, acceptable HALS outcomes were achieved from the outset. Thus, concerns about initial quality-related outcomes should not be an obstacle to surgeons who are considering the adoption of this technique. Increased use of HALS could increase the number of patients who would benefit from minimal access colon and rectal resections.

In conclusion, HALS technique has provided all the benefit of a minimal invasive surgery for the patients who underwent colorectal resections due to left sided colon and upper rectal cancer. HALS colorectal resection is a safe and effective procedure. Our study is one of the larger of only a few observational studies on HALS on both left-sided colon and rectal resections. The study can be regarded as a population-based study because our institution performs all HALS for left sided colon and rectal cancer in Lithuania, and only a few HALS are performed in other institutions.

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