

Laparoscopic colorectal surgery for colorectal polyps: experience of ten years

Audrius Dulskas¹,

Žygimantas Kuliešius¹,

Narimantas E. Samalavičius^{1,2}

¹Department of Abdominal and General Surgery and Oncology, National Cancer Institute, Vilnius, Lithuania

²Clinic of Internal Diseases, Family Medicine and Oncology, Faculty of Medicine, Vilnius University Vilnius, Lithuania

Background. Laparoscopy or its combination with endoscopy is the next step for “difficult” polyps. The purpose of the paper was to review the outcomes of the laparoscopic approach to the management of “difficult” colorectal polyps.

Materials and methods. From 2006 to 2016, 58 patients who underwent laparoscopic treatment for “difficult” polyps that could not be treated by endoscopy at the National Cancer Institute, Lithuania, were included. The demographic data, the type of surgery, length of post-operative stay, complications, and final pathology were reviewed prospectively.

Results. The mean patient was 65.9 ± 8.9 years of age. Laparoscopic mobilization of the colonic segment and colotomy with removal of the polyp was performed in 15 (25.9%) patients, laparoscopic segmental bowel resection in 41 (70.7%) cases: anterior rectal resection with partial total mesorectal excision in 18 (31.0%), sigmoid resection in nine (15.5%), left hemicolectomy in seven (12.1%), right hemicolectomies in two (3.4%), ileocecal resection in two (3.4%), resection of transverse colon in two (3.4%), and sigmoid resection with transanal retrieval of specimen in one (1.7%). Two patients (3.4%) underwent laparoscopic-assisted endoscopic polypectomy. The mean post-operative hospital stay was 5.7 ± 2.4 days. There were four complications (6.9%). All patients recovered after conservative treatment. The mean polyp size was 3.5 ± 1.9 cm. Final histopathology revealed hyperplastic polyps ($n = 2$), tubular adenoma ($n = 9$), tubulovillous adenoma ($n = 31$), carcinoma in situ ($n = 12$), and invasive cancer ($n = 4$).

Conclusions. For the management of endoscopically unresectable polyps, laparoscopic surgery is currently the technique of choice.

Keywords: laparoscopic surgery, colectomy, colorectal polyp, endoscopic polypectomy, difficult polyp

INTRODUCTION

Globally, colorectal cancer (CRC) ranked third for cancer incidence and fourth for cancer death

Correspondence to: Audrius Dulskas, Department of Abdominal and General Surgery and Oncology, National Cancer Institute, 1 Santariškių St, Vilnius LT-08406, Lithuania. E-mail: audrius.dulskas@gmail.com

in 2013. For developed countries, it ranked second for incidence and mortality, and in developing countries it ranked fourth for both incidence and mortality (1). Adenomatous colorectal polyps have a malignant potential well described in Vogelstein's adenoma-carcinoma sequence (2, 3). CRC prevention depends largely on the detection and removal of adenomatous polyps. There are several methods

to remove polyps by using either endoscopic, surgical, or combined methods (4). Patients who have known adenomas and refuse removal develop colon cancer at the rate of 4% after 5 years and 14% after 10 years, which is higher than that of the general population (5). Endoscopic removal of polyps has been shown to arrest subsequent development of carcinoma (6).

Most of the polyps can be removed endoscopically using well-established principles. However, there is a group of polyps that are challenging even to the most advanced endoscopist. These so-called "difficult polyps" comprise about 10–15% of all polyps (7). They may be difficult to remove because of their size, configuration, and location in the colon. For example, large sessile polyps or polyps spanning two folds present technical challenges (8). Criteria for sessile polyps that can be managed by endoscopic mucosal resection (EMR) is continually evolving with the majority of such lesions being safely and effectively treated through endoscopy (9). Repeat colonoscopy for endoscopic resection at expert centres is an appropriate next step and can often result in successful endoscopic management. However, no matter how skilled the endoscopist or how many different methods are used, there remains a subset of polyps that cannot be removed completely using the endoscopic approach alone. For these polyps surgical treatment is usually the next step. The majority of patients with difficult polyps will undergo segmental colon resection even if the polyp appears completely benign. Some patients may historically undergo a colostomy and polypectomy for only benign polyps (10). There are, however, hybrid methods that combine endoluminal and endocavitary approaches to offer less radical and minimally invasive resections for the benign-appearing difficult polyp. The use of laparoscopy assistance in dealing with polyps is usually a last-resort manoeuvre when all other options are exhausted.

The potential advantages of laparoscopic over open surgery are faster recovery, a low rate of incisional hernia, lesser blood loss, improved pulmonary function, earlier return of bowel function, decreased post-operative hospital stay, improved quality of life, and the reduction of peritoneal adhesions (11). There have been a number of small reports on laparoscopic removal of colorectal polyps (11, 12).

MATERIALS AND METHODS

From April 2006 to August 2016, over 1,500 endoscopic polypectomies were performed at the Department of Abdominal and General Surgery and Oncology of the National Cancer Institute, Lithuania. During this period more than 450 laparoscopic colorectal operations were performed. A prospectively maintained database was used to identify all patients who underwent laparoscopic polypectomy for polyps that could not be removed by endoscopy due to size, location, and/or risk of complications. The exact reasons why the referring endoscopist could not achieve endoscopic polypectomy were not available. All consenting patients aged 18 years and older with histologically confirmed adenoma were included in this study. Invasive carcinoma was the criterion for exclusion. The demographic data, past surgical history, the type of surgery, length of post-operative stay, complications, final pathology, and the stage of cancer (if present) were analysed prospectively.

The surgical technique

All laparoscopic procedures were performed by skilled surgeons in the department. Preoperative polyp marking was used if the polyp was not in the cecal area. For marking methylene blue in the morning of the operation was used. Preoperative bowel preparation the day before surgery and intravenous broad-spectrum antibiotics (Cefuroxime and Metronidazole) on induction anaesthesia were routine. For hand-assisted laparoscopic surgery (HALS) a 6 cm umbilical incision was made for the hand-port insertion. Trocars were placed according to the type of procedure. If a bowel resection was performed, the vascular pedicles were initially isolated by a medial to lateral approach, the ureters identified, and a ligation of the vessels performed. Bowel mobilization was then completed laparoscopically. The specimens were retrieved through the trans-umbilical incision and colotomy, and polypectomy (if the polyp was benign looking with proven biopsy, not circular, and possible to remove) or resection and anastomosis performed extra-corporeally. Contraindications for colotomy and polyp removal were: a circular polyp, a dysplastic polyp in the initial biopsy, and the risk of bowel stenosis. For laparoscopic anterior resections intra-corporeal anastomosis with an endoanal

circular stapler was done. Hand-assisted laparoscopic surgery was performed for polyps localized in the descending colon, sigmoid and rectum, which was possible for specimen retrieval through the trans-umbilical incision. If a straight laparoscopy was performed, mobilization of the bowel was performed using the standard technique. The segment was brought through the incision above the mobilized bowel and colotomy, and polypectomy or small resection and anastomosis were done. If a hybrid laparoscopic-assisted endoscopic polypectomy was performed, the laparoscopic part was performed as same previously described technique with the patient in lithotomic position and endoscopist standing between patients legs. The follow-up was performed under our institutional guidelines: colonoscopy annually.

Statistical analysis

All statistical analyses were performed using software (Statistical Package for the Social Sciences, SPSS Inc., Chicago, IL, USA). All data are presented as mean \pm standard deviation for parametric, and median for nonparametric data.

RESULTS

Patients' demographics are shown in Table 1. Patients' body mass index was 28.5 ± 6.3 kg/m² (range: 22–36 kg/m²). Thirteen patients (22.4%) had multiple polyps (2 or more). 26 (44.8%) patients had comorbidities: 24 of them (41.4%) cardiac, two (3.4%) diabetes. Laparoscopic mobilization

Table 1. Demographic data of 58 patients who underwent surgical treatment for “difficult” polyps

Variable	n (%)
Male	29 (50%)
Female	29 (50%)
Mean age	65.9 \pm 8.9 (range: 50 to 83 years)
Previous abdominal surgery	2 (3.4%)
Preoperative pathology	
Adenoma	50 (86.2%)
Ca in situ	8 (13.8%)
Mean post-operative hospital stay	5.7 \pm 2.4 days (range from 1 to 14 days)
Conversion rate	0
Mortality rate	0

of the colonic segment and colotomy and removal of the polyp were performed on 15 (25.9%) patients (Table 2). Laparoscopic segmental bowel resection was performed in 41 (70.7%) cases (Tables 2 and 3). There were 23 polyps in the sigmoid colon (39.7%), 19 (32.8%) polyps in the rectum, four in ascending colon (6.9%) and cecum (6.9%), three in the transverse colon (5.2%), two in the descending colon (3.4%) and left flexure (3.4%), and one in the right flexure (1.7%). Hand-assisted laparoscopic surgery was performed on 37 patients, straight laparoscopy on 19, and laparoscopic-assisted procedure on two patients. The mean post-operative hospital stay was 5.7 ± 2.4 days (range from 1 to 14 days). All patients but four (6.9%) recovered well and had an uneventful post-operative course. Four post-operative complications were encountered (perioperative morbidity – 6.9%): urinary tract infection in two patients, partial ileus in one, and urinary retention in one. All patients recovered after conservative treatment (Grade II according to Clavien-Dindo classification). There were no deaths or conversions in our group. The mean polyp size was 3.5 ± 1.9 cm (range from 1 to 10 cm). Final histopathology revealed polyps (juvenile and hyperplastic $n = 2$), tubular adenoma ($n = 9$), tubulovillous adenoma ($n = 31$), carcinoma in situ ($n = 12$) and invasive cancer ($n = 4$): pT1 in three cases and pT2 neuroendocrine cancer in one (Table 4). Two of these patients underwent laparoscopic left

Table 2. Laparoscopic surgical procedures performed on 58 patients with “difficult” polyps

Site of bowel	Surgical procedure performed	Number
Right colon	Laparoscopy-assisted endoscopic polypectomy	1
	Right hemicolectomy	2
	Ileo-cecal resection	2
Transverse colon	Colotomy	4
	Colotomy	1
Descending colon	Bowel resection	2
	Left hemicolectomy	1
Sigmoid colon	Colotomy	2
	Laparoscopy assisted endoscopic polypectomy	1
	Left hemicolectomy	6
Rectum	Colotomy	8
	Sigmoid resection	10
	Anterior resection	18

Table 3. Surgical procedures performed on 58 patients with “difficult” polyps

Procedure	n (%)
Colotomy and removal of polyp	15 (25.9%)
Laparoscopic bowel resection	41 (70.7%)
Anterior rectal resection	18 (31.0%)
Sigmoid resection	9 (15.5%)
Left hemicolectomy	7 (12.1%)
Ileocaecal resection	2 (4.76%)
Right hemicolectomy	2 (3.4%)
Resection of transverse colon	2 (3.4%)
Sigmoid resection with transanal retrieval of specimen	1 (1.7%)
Laparoscopic-assisted endoscopic polypectomy	2 (3.4%)

Table 4. Final histopathology of 58 resected specimens

Histopathology result	N (%)
Hyperplastic polyp	2 (3.45)
Invasive cancer (pT1, T2)	4 (6.90)
Tubular adenoma	9 (15.51)
Ca in situ	12 (20.69)
Tubulovillous adenoma	31 (53.45)

hemicolectomies 14 and 10 days after laparoscopic colotomy and polypectomy. All the patients were followed with colonoscopy for 12 months post-operatively, then yearly thereafter. The mean follow-up was 2 years (range: 6 months – 5 years). There was no incidence of recurrence or any late complications.

DISCUSSION

Adenomatous polyps are known as precursors of colorectal cancer (2, 3). The rate of adenomas containing invasive cancer has been estimated as high as almost 10% (7). There are many modalities for treatment of difficult polyps. With improved technical tools and techniques endoscopic polyp removal still remains the first line choice for treatment (13). However, even after a complete endoscopic resection of a polyp, the residual malignant disease (in the colon wall or regional lymph nodes) can be as high as 39% in malignant polyps with unfavorable histology (14). So the risks and benefits of laparoscopic surgery versus endoscopic treatment alone favour the laparoscopic or hybrid laparoendoscopic approach (13). According to some authors, majority of patients with difficult polyps will undergo segmental colon resection even if the polyp appears completely benign (6).

Surgical options include colotomy with polypectomy in the case of pedunculated polyps and small colectomy in the case of large, broad-base polyps. Polyps that have established or even possible development of malignant transformation require a formal oncologic resection with central vascular ligation and lymphadenectomy (11, 15, 16). In our study, we performed 15 (25.9%) colotomies with mobilization of the colon and polypectomy, and 41 (70.7%) bowel resections. Some authors are against colotomy because of the high possibility of exposing the abdominal cavity to cancer cells (17). Two patients underwent laparoscopic-assisted endoscopic polypectomy. Only two larger studies assessing this technique have been recently published (18, 19). Authors concluded that this technique is safe for benign polyps and if malignancy is suspected laparoscopic colectomy can be performed without delay.

In our previous report we showed that a polyp larger than 2.0 cm in diameter carries a risk of malignancy (10). Furthermore, Wasif et al. showed that polyps larger than 3 cm could be completely excised only in 67–75% of cases, thus questioning the endoscopic approach (5). In our present study, a large polyp size is the commonest cause for laparoscopic removal of colorectal polyps after a suspected malignancy. The median size of these large polyps was 3.5 ± 1.9 cm (range: 1–10 cm). It is difficult to reliably predict which patients would have invasive cancer after removal. In general, polyps smaller than 2 cm, soft in consistency are nonulcerated, and demonstrate regular pit and vascular patterns are more likely to be benign (13). The association between the increasing polyp size and the possibility of harbouring

cancer is well known. This is well shown in our study: four of 49 (8.2%) polyps of 2 cm or more in size (two 2 cm and two 5 cm) harboured invasive cancer (Table 5).

Table 5. Cancer risk according to the polyp size

Size	Number of polyps (n58)	Incidence of cancer (%)
≤1 cm	2	0
>1 cm, <2 cm	7	0
≥2 cm, <5 cm	38	2 (5.2%)
≥5 m	11	2 (18.2%)

In colorectal surgery, we have been using laparoscopy for ten years. The results of our study, the post-operative hospital stay, and complications are comparable to those reported in the literature (20–23), with no mortality or conversions documented in our cases.

Straight laparoscopic procedures have known disadvantages: a lack of tactility and the difficulties in defining the extent of the resection (6, 23). These disadvantages are overcome by HALS or various combinations of laparoscopic-endoscopic procedures, including laparoscopically-assisted endoscopic polypectomy, endoscopically-assisted wedge or anatomical resections, and, finally, an intraoperative tumour location by colonoscopy for achieving oncological resection margins in laparoscopic curative resections. All of these combinations allow a minimally invasive approach for lesions that would otherwise necessitate a laparotomy (6, 13). In the dawn of laparoscopy, Fleshman with co-authors recommended performing a mini laparotomy for colonic polyps (24). However, the authors experienced some difficulties of inability to perform a splenic flexure mobilization through mini laparotomy. In general, compared to mini laparotomy, it is easier to perform an extended mobilization and resection with HALS (25).

CONCLUSIONS

Large colonic polyps unresectable at colonoscopy are associated with a high rate of unsuspected cancer, and these polyps require a formal oncologic colectomy rather than a trans-colonic polypectomy. Laparoscopic colectomy offers a safe and effective means of eradicating these polyps with the benefits

of early post-operative recovery and should be considered as standard care today.

Conflict of interest

The authors declare no conflict of interest.

Received 8 September 2016

Accepted 14 March 2017

References

1. Global Burden of Disease Cancer Collaboration. The Global Burden of Cancer 2013. *JAMA Oncol.* 2015; 1: 505–27.
2. Sievers CK, Zou L, Pickhardt PJ, Matkowskyj KA, Albrecht D, Kim DH, et al. Modeling the rise of intratumoral heterogeneity in growing, static, and regressing human colorectal polyps. *Cancer Research Supplement.* 2016: 151–151.
3. Cho KR, Vogelstein B. Genetic alterations in the adenoma-carcinoma sequence. *Cancer.* 1992; 70: 1727–31.
4. Monkemuller K, Neumann H, Malfertheiner P, Fry LC. Advanced colon polypectomy. *Clin Gastroenterol H.* 2009; 7: 641–52.
5. Wasif N, Etzioni D, Maggard MA, Tomlinson JS, Ko CY. Trends, patterns, and outcomes in the management of malignant colonic polyps in the general population of the United States. *Cancer.* 2011; 117: 931–7.
6. Winter H, Lang RA, Spelsberg FW, Jauch KW, Hüttl TP. Laparoscopic colonoscopic rendezvous procedures for the treatment of polyps and early stage carcinomas of the colon. *Int J Colorectal Dis.* 2007; 22: 1377–81.
7. Zhang M, Shin EJ. Successful endoscopic strategies for difficult polypectomy. *Curr Opin Gastroenterol.* 2013; 29: 489–894.
8. Pishvaian AC, Al-Kawas FH. Retroflexion in the colon: A useful and safe technique in the evaluation and resection of sessile polyps during colonoscopy. *Am J Gastroenterol* 2006; 101: 1479–83.
9. Moss A, Bourke MJ, Williams SJ, Hourigan LF, Brown G, Tam W, et al. Endoscopic mucosal resection outcomes and prediction of submucosal cancer from advanced colonic mucosal neoplasia. *Gastroenterology.* 2011; 140: 1909–18.

10. Dulskas A, Samalavicius NE, Gupta RK, Zambulis V. Laparoscopic colorectal surgery for colorectal polyps: single institution experience. *Videosurgery and Other Miniinvasive Techniques*. 2015; 10: 73–8.
11. Hauenschild L, Bader FG, Laubert T, Czymek R, Hildebrand P, Roblick UJ, et al. Laparoscopic colorectal resection for benign polyps not suitable for endoscopic polypectomy. *Int J Colorectal Dis*. 2009; 24: 755–9.
12. Pokala N, Delaney CP, Kiran RP, Brady K, Senagore AJ. Outcome of laparoscopic colectomy for polyps not suitable for endoscopic resection. *Surg Endosc*. 2007; 21: 400–3.
13. Aslani N, Alkhamesi NA, Schlachta CM. Hybrid laparoendoscopic approaches to endoscopically unresectable colon polyps. *J Laparoendosc Adv Surg Tech A*. 2016; 26: 581–90.
14. Bujanda L, Cosme A, Gil I, Arenas-Mirave JI. Malignant colorectal polyps. *World J Gastroenterol*. 2010; 16: 3103–11.
15. Nassiopoulos K, Pavlidis TE, Menenakos E, Chanson C, Zografos G, Petropoulos P. Laparoscopic colectomy in the management of large, sessile, transformed colorectal polyps. *JSLs* 2005; 9: 58–62.
16. Jang JH, Balik E, Kirchoff D, Tromp W, Kumar A, Grieco M. Oncologic colorectal resection, not advanced endoscopic polypectomy, is the best treatment for large dysplastic adenomas. *J Gastrointest Surg*. 2012; 16: 165–72.
17. Loungnarath R, Mutch MG, Birnbaum EH, Read TE, Fleshman JW. Laparoscopic colectomy using cancer principles is appropriate for colonoscopically unresectable adenomas of the colon. *Dis Colon Rectum*. 2010; 53: 1017–22.
18. Franklin ME Jr, Portillo G. Laparoscopic monitored colonoscopic polypectomy: long-term follow-up. *World J Surg*. 2009; 33: 1306–9.
19. Garrett KA, Lee SW. Combined endoscopic and laparoscopic surgery. *Clin Colon Rectal Surg*. 2015; 28: 140–5.
20. Church J, Erkan A. Scope or scalpel? A matched study of the treatment of large colorectal polyps. *ANZ J Surg* 2016 [Epub ahead of print].
21. Schwenk W, Haase O, Neudecker J, Muller JM. Short term benefits for laparoscopic colorectal resection. *Cochrane Database Syst Rev*. 2005; 20: CD003145.
22. Benedix F, Kockerling F, Lippert H, Scheidbach H. Laparoscopic resection for endoscopically unresectable colorectal polyps: analysis of 525 patients. *Surg Endosc*. 2008; 22: 2576–82.
23. Benlice C, Costedio M, Stocchi L, Abbas MA, Gorgun E. Hand-assisted laparoscopic vs open colectomy: an assessment from the American College of Surgeons National Surgical Quality Improvement Program procedure-targeted cohort. *Am J Surg*. 2016 [Epub ahead of print].
24. Fleshman JW, Fry RD, Birnbaum EH, Kodner IJ. Laparoscopic-assisted and minilaparotomy approaches to colorectal diseases are similar in early outcome. *Dis Colon Rectum*. 1996; 39: 15–22.
25. Tajima T, Mukai M, Yamazaki M, Higami S, Yamamoto S, Hasegawa S, et al. Comparison of hand-assisted laparoscopic surgery and conventional laparotomy for colorectal cancer: interim results from a single institution. *Oncol Lett*. 2014; 8: 627–32.

**Audrius Dulskas, Žygimantas Kuliešius,
Narimantas Evaldas Samalavičius**

**LAPAROSKOPINĖ CHIRURGIJA TIESIOSIOS
IR GAUBTINĖS ŽARNOS POLIPAMS
ŠALINTI: 10 METŲ PATIRTIS**

Santrauka

Įvadas. Laparoskopija ar jos derinimas su endoskopija yra puiki alternatyva endoskopiškai nepašalinamiems žarnos polipams šalinti. Tyrimo tikslas – apžvelgti šios metodikos taikymo rezultatus.

Medžiaga ir metodai. Tyrime dalyvavo 58 pacientai, 2006–2016 m. operuoti Nacionaliniame vėžio institute dėl endoskopiškai nepašalinamų polipų. Perspektyviai analizuoti demografiniai rodikliai, operacijos tipas, pooperacinio periodo trukmė, komplikacijos ir galutinis histologijos atsakymas.

Rezultatai. Vidutinis pacientų amžius buvo $65,9 \pm 8,9$ metai. Laparoskopinė žarnos mobilizacija, kolotomija ir polipo šalinimas atlikta 15 (25,9 %) pacientų, laparoskopinė žarnos segmentinė rezekcija – 41 (70,7 %) atveju: priekinė

tiesiosios žarnos rezekcija su daline mezorektaline ekscizija – aštuoniolikai (31,0 %), riestinės žarnos rezekcija – devyniems (15,5 %), kairioji hemikolektomija – septyniems (12,1 %), dešinioji hemikolektomija – dviems (3,4 %), ileocekalinio kampo rezekcija – dviems (3,4 %), skersinės žarnos rezekcija – dviems (3,4 %) ir riestinės žarnos rezekcija su preparato šalinimu *per anus* – vienam (1,7 %) pacientui. Dviems pacientams (3,4 %) atlikta laparoskopiskai asistuojanti endoskopinė polipektomija. Vidutinė pooperacinio periodo trukmė buvo $5,7 \pm 2,4$ dienos. Keturiems pacientams pasireiškė komplikacijos (6,9 %). Nei vienam iš jų neprireikė reintervencijos. Vidutinis polipo dydis $3,5 \pm 1,9$ cm. Galutinė patologijos diagnozė: hiperplastinis polipas ($n = 2$), tubulinė adenoma ($n = 9$), tubuloviliozinė adenoma ($n = 31$), carcinooma *in situ* ($n = 12$) ir vėžys ($n = 4$).

Išvados. Endoskopiškai nepašalinamų storosios ir tiesiosios žarnos polipų atvejais laparoskopija yra pirmo pasirinkimo metodas.

Raktažodžiai: laparoskopinė chirurgija, kolektomija, tiesiosios ir gaubtinės žarnos polipas, sudėtingas polipas