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Ileocecal Valve Sparing Resection for the Treatment of Benign Cecal Polyps Unsuitable for Polypectomy

Souhaylah Abdalla, Hélène Meillat, MD, Claire Fillol, MD, Kevin Zuber, MS, Gilles Manceau, MD, PhD, Vincent Dubray, MD, Laura Beyer-Berjot, MD, PhD, Jérémie H. Lefevre, MD, PhD, Marie Selvy, MD, Stéphane Benoist, MD, PhD, Renato Micelli Lupinacci, MD, PhD, and on behalf of the French Group: Christine Denet, MD, Guillaume Piessen, MD, PhD, Denis Pezet, MD, Pénélope Raimbert, Alain Valverde, MD, Anouk Esch, MD

ABSTRACT

Background: Not all benign-appearance polyps are amenable to endoscopic removal and colectomy is required in some cases. This study aims to compare the early outcomes of cecal wedge resection with ileocecal valve sparring versus standard right colectomy in patients with endoscopically unresectable cecal polyps referred for surgery.

Methods: From Apr 2010 to Aug 2019, all consecutive patients who underwent cecal wedge resection or right colectomy in ten European centers for a presumed endoscopically benign polyp unsuitable for endoscopic resection were retrospectively analyzed. The primary endpoint was morbidity. Secondary endpoints were operative time and length of hospital stay.

Results: One hundred and ten patients were included: 25 patients underwent cecal wedge resection and 85 a right colectomy. There were 56 men (51%) and 90% of the procedures were performed laparoscopically. 29 lesions were located at the appendix orifice (26.4%). Mortality was nil. There were no significant differences between both procedures for morbidity rate (20% versus 24.7%) or reoperation (4% versus 4.7%). Cecal wedge was related to shorter operative time (63 min versus 150 min, $P = .008$) and shorter hospital stay (5 days versus 6 days, $P = .049$). Only 1 patient had a salvage right colectomy after cecal wedge for a pTis adenoma.

Conclusions: For benign-appearance cecal polyps unsuitable for endoscopic ablation, cecal wedge resection is safe and should be considered as an attractive alternative to right colectomy.

Universitätsklinikum Freiburg, 79106 Freiburg im Breisgau, Germany (Dr. Abdalla).

Institut Paoli-Calmette, 13009 Marseille, France (Dr. Meillat).

Institut Mutualiste Montsouris, 75014 Paris, France (Dr. Fillol).

Fondation Ophtalmologique Rothschild, Paris, France (Dr. Zuber).

Hôpital Pitié Salpêtrière, 75013 Paris, France (Dr. Manceau).

Université de Lille, Service de Chirurgie Digestive et Générale, Hôpital Claude Huriez, CHU de Lille, 59037 Lille, France (Dr. Dubray).

Hôpital Nord. AP-HM, Chemin des Bourrely, 13015 Marseille, France (Dr. Beyer-Berjot).

Sorbonne Université, Department of Digestive Surgery, AP-HP, Hôpital St Antoine, 75012 Paris, France (Dr. Lefevre).

Service de Chirurgie Digestive, CHU Estaing, 63100 Clermont-Ferrand, France (Dr. Selvy).

Service de Chirurgie Digestive et Oncologique, CHU Bicêtre, 94270 Le Kremlin-Bicêtre, France (Dr. Benoist).

Service de Chirurgie Digestive et Oncologique, Hôpital Ambroise Paré, 92104 Boulogne-Billancourt, France (Dr. Micelli Lupinacci).

Institut Mutualiste Montsouris, Paris, France (Dr. Denet).

Université de Lille, Service de Chirurgie Digestive et Générale, Hôpital Claude Huriez, France (Dr. Piessen).

Service de Chirurgie Digestive, CHU Estaing, France (Dr. Pezet).

Service de Chirurgie Digestive et Oncologique CHU Bicêtre, France (Dr. Raimbert).

Service de Chirurgie Digestive, Groupe Hospitalier Diaconesses Croix Saint Simon, Paris, France (Dr. Valverde).

Service de Gastroenterologie et Endoscopie Digestive, Groupe Hospitalier Diaconesses Croix Saint Simon, Paris, France (Dr. Esch).

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Address correspondence to: Renato Micelli Lupinacci MD, PhD, Service de Chirurgie Digestive et Oncologique, Hôpital Ambroise Paré, 9 Ave Charles de Gaulle, 92104 Boulogne-Billancourt, France. Telephone: 01-49-09-47-82; Fax: 01-49-09-58-69; E-mail: renato.lupinacci@aphp.fr.

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INTRODUCTION

The widespread use of colonoscopy screening has dramatically increased the rate of detection of colorectal polyps, which resulted in the reduction of mortality from colorectal cancer observed in recent decades.[1] The risk of unexpected invasive cancer incidentally found after endoscopic polyp ablation is accepted to be considerably low (approximately 2% to 5%) and provides the rationale for the endoscopic resection of these lesions.[2–4]

Not all premalignant colorectal lesions are amenable to endoscopic removal and some characteristics, such as size, morphology, or location of the polyp can make endoscopic ablation hazardous despite the development of new techniques.[5,6] This is particularly true for difficult anatomical situations such as the appendix orifice or for large flat cecal lesions.[6,7] In these situations, the patient is referred to surgeon for colorectal resection, and a standard "oncologic" or radical segmental resection is often the only treatment offered.[8–11]

For those polyps located adjacent to the appendix orifice or at the bottom of the cecum, a limited full-thickness wall resection has been previously described.[12] Although it is a sound alternative that spares the ileocecal valve, literature is scarce and includes small case series and only one study comparing it with standard right colectomy.[13]

The aim of this large retrospective study was to compare early surgical outcomes of cecal wedge resection and right colectomy for endoscopically benign polyps unsuitable for endoscopic ablation and referred to surgeon.

MATERIALS AND METHODS

Study Population

Patients with cecal polyps considered unsuitable for endoscopic resection and referred to ten European surgical departments over a nine-year period were retrospectively reviewed. Cecal wedge was performed by five centers (four in France and one in Germany). A surgical cooperative French scientific group approved the design of this study: *Fédération de Recherche en Chirurgie* (FRENCH). The inclusion criteria were age over 18 years, and polyps were located in the cecum and at least 1 cm apart from the ileocecal valve. Patients were excluded if they had (at the discretion of the gastroenterologist) polyps suspected on colonoscopy to harbor invasive adenocarcinoma previously to surgery. The study protocol was approved by the Paris Saclay Ethics Commitee (CER Polethis number 225).

Collected data included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) grade, polyp location (appendix orifice or cecum), previous abdominal surgery, operative approach (laparoscopy or open), operative time, intraoperative complication, final pathology results (size of the polyp in mm, resection margins, presence of any invasive component [considered if $\geq$ T1sm1]), estimated blood loss (EBL), conversion to laparotomy, reoperation, length of stay (LOS), readmission (within 30 days after surgery). Postoperative morbidity was defined as any complication developing within 30 days and was graded according to the Clavien–Dindo classification. Major complications were classified as those requiring surgical, endoscopic or radiological intervention (Clavien–Dindo grade III) or intensive care management (grade IV).[14]

Surgical Procedures

Bowel preparation, patient's placement, surgical approach, and trocars' position depended on each center's discretion. The technique of cecal wedge resection did not differ from previously described articles.[12,13,15] Briefly, the cecum was identified and mobilized from the lateral abdominal wall and freed from the retroperitoneum. The mesoappendix was divided according to the surgeon's preferred technique. Cecal wall was divided distal to the ileocecal valve using a linear stapler. Reinforcement suture on the staple-line depended on the surgeon's preference. Macroscopic evaluation of the cecal wedge specimen by the surgeon was systematically performed, whereas frozen section analysis depended on the surgeon's discretion. Right colectomy was performed following oncological principles with division of the feeding vessels at their origin. Type of anastomosis (intra- or extracorporeal) and drainage were not evaluated.

Statistical Analysis

The primary endpoint was morbidity. Secondary endpoints were operative time and length of hospital stay.

Categorical variables were compared between groups using a χ^2 test or Fisher's exact test whenever appropriate. Continuous variables were compared between groups using a *t* test or Mann-Whitney U test when the variable was not normally distributed. Normality was assessed using the

Table 1.
Demographics

	Cecal Edge Resection (n = 25)	Right Colectomy (n = 85)	All Patients (n = 110)	*P*-value
Age, years, mean, range	65, 8 (45–83)	67, 8 (39–90)	67, 3	0.42[a]
Sex, n, %				0.43[b]
Men	11 (44%)	45 (52, 9%)	56 (50, 9%)	
Women	14	40	54	
BMI, Kg/m^2, median, IQR	27, 7 (24, 3–29)	25, 7 (21, 7–28, 9)	25, 8 (22, 8–29)	0.19[c]
Previous abdominal surgery, n, %				0.74[b]
Yes	14 (56%)	49 (59, 8%)	63 (58, 9%)	
No	11	33	44	
Location of the polyp, n, %				<0.001[b]
Cecum	12 (48%)	69 (81, 2%)	81 (73, 6%)	
Appendix orifice	13	16	29	
ASA score, n, %				0.39[b]
1–2	17 (81%)	58 (71, 6%)	75 (73, 5%)	
3–4	4	23	27	
Surgical approach, n, %				0.45[d]
Open	1 (4.0%)	10 (11.8%)	11 (10.0%)	
Laparoscopy	24	75	99	

BMI, body mass index (Kg/m^2); ASA, American Society of Anesthesiologists; EBL, estimated blood loss.
Statistics: [a]Student's *t* test; [b]χ^2 test; [c]Mann-Whitney U test; [d]Fisher's exact test.

Shapiro-Wilk test. Univariate and multivariate analysis (including only variables with $P \leq .2$ in univariate analysis) were used to identify factors related to postoperative complications. A $P < .05$ was considered statistically significant. Statistical analyzes were performed on R version 30.60.1.

RESULTS

A total of 110 patients were referred to surgery from Apr 2010 to Aug 2019. Cecal wedge resection was performed in 25 patients (220.7%) and right colectomy (RC) in 85. Demographics are summarized in **Table 1**. There were no differences between the two groups for age, sex, BMI, previous abdominal surgery, ASA score, or surgical approach. Cecal wedge resections were more often performed for appendix orifice polyps (52% versus 19%, $P < .001$). Location of the polyp was the commonest reason for declining endoscopic polypectomy (n = 19, 76%), whereas size (≥ 30 mm) contraindicated polypectomy in 6 patients. The median size of the polyp was greater in the RC group although it was not statistically significant (20 mm versus 25 mm; $P = .09$).

There was no differences in overall and severe complication rates (20% versus 240.7%, $P = .63$ and 4% versus 50.9%, $P = 1$, respectively). One patient had a severe complication (Clavien-Dindo grade 3 fistula, requiring readmission and a total of 9 days in hospital) after wedge resection. As expected, right colectomy was associated with a longer operative time (63 minutes versus 150 minutes; $P = .008$) and longer LOS (mean, 5 days versus 6 days; $P = .049$). Estimated blood loss was slightly greater after right colectomy (median, 15 mL (0–200) versus 50 mL (0–300), $P = .30$) There were no differences regarding both reoperation and readmission. Intraoperative and early postoperative outcomes are shown in **Table 2**.

Cecal wedge resection was completely performed by laparoscopy in 21 patients (84%), and 3 (12%) patients had only laparoscopic cecal mobilization with bowel resection being performed through a small laparotomy after digital palpation confirmed the possibility of preserving the ileocecal valve. Right colectomy was performed laparoscopically in 75 (880.2%) patients among whom 3 (4%) needed conversion to open surgery because of bowel perforation (n = 2), or bleeding (n = 1).

Univariate and multivariate analysis of risk factors for postoperative complications showed only operative time to be associated with postoperative complications (**Table 3**).

Among the 25 patients who underwent a cecal wedge at first intention, only 1 (4%) required a complementary

Table 2.
Intraoperative Characteristics, Early Postoperative Outcomes, and Main Pathological Characteristics

	Cecal Edge Resection (n = 25)	Right Colectomy (n = 85)	All Patients (n = 110)	*P*-value
Intraoperative complications, n, %				0.32[a]
Yes	2 (8%)	3 (3.5%)	5 (4.5%)	
No	23	82	105	
EBL, mL, median, range	15 (0–200)	50 (0–300)	50 (0–300)	0.305[b]
Operative time, min, median, IQR	63 (43–146, 25)	150 (120–186)	140 (110–181)	0.008[c]
Overall complications, n, %				0.63[d]
Yes	5 (20%)	21 (24.7%)	26 (23.6%)	
No	20	64	84	
Severe complications, n, %[e]				1[a]
Yes	1 (4%)	5 (5.9%)	6 (5.4%)	
No	24	80 (94.1%)	104	
Reoperation, n, %				1[a]
Yes	1 (4%)	4 (4.7%)	5 (4.5%)	
No	24	81	105	
Rehospitalisation, n, %				0.38[a]
Yes	3 (12%)	5 (5.9%)	8 (7.3%)	
No	22	80	102	
LOS, days, median, IQR	5 (4–6)	6 (5–8)	6 (4–7, 75)	0.0496[c]
Invasive component[f], n, %				0.011[d]
Yes	0 (0%)	17 (20%)	17 (15.5%)	
No	25	68	93	
Size of the polyp, mm, median, IQR	20 [11–29)	25 (15–32)	25 (15–32)]	0.09[c]

EBL, estimated blood loss; LOS, hospital length of stay.
Statistics: [a]Fisher's exact test; [b]Student's *t* test; [c]Mann-Whitney U test; [d]χ^2 test.
[e]Clavien-Dindo ≥3; [f]adenocarcinoma ≥ T1 on final pathological report.

right colectomy after a frozen section was suspected of the presence of an invasive adenocarcinoma that finally turned out to be a carcinoma in situ (Tis). The final pathology report confirmed that all patients (including the one who had a right colectomy) operated by cecal wedge resection had free resection margins and noninvasive (≤Tis) lesions. Among the 85 patients who underwent a right colectomy, final pathologies reported the presence of an invasive component in 17 patients (20%).

DISCUSSION

In this large multicentric retrospective series, cecal wedge resection allowed transmural polyp excision with free resection margins. Compared to the right colectomy, the morbidity rate was not significantly different, whereas operative time and hospital stay were significantly lower. No invasive malignancies were identified after cecal wedge resections. Based on these findings, cecal wedge resection may be considered an option for selected patients with benign appearance cecal polyps unsuitable for endoscopic resection.

Several authors have described limited resection for polyps located in the cecum and adjacent to the appendix orifice termed "cecal wedge resection,"[15,16] "partial cecectomy,"[13] or "radical appendectomy".[12] All are single center series,[12,13,15,16] and only the study of Kulaylat et al[13] compared the outcomes with those undergoing oncologic resections. Noteworthy, in all four previously published series, there were no invasive (≥pT1) adenocarcinomas after cecal wedge resection that required a complementary oncologic resection.

One potential drawback of cecal wedge resection is the risk that it does not encompass the polyp into the resected specimen. Kulaylat et al[13] converted 2 out of 19 patients to right colectomy because the polyp was missing in the specimen. It has been proposed the additional use of intraoperative colonoscopy,[16] which could theoretically provide the benefit of localizing the polyp and confirming macroscopic free margins. However, intraoperative

Table 3.
Uni- and Multivariate Analysis of Risk Factors for Postoperative Complications

	Univariate		Multivariate	
	Odds Ratio	*P*	Odds Ratio	*P*
Age	1.03 (0.99–1.08)	0.13	1.03 (0.98–1.08)	0.28
Sex (man)	1.43 (0.59–3.54)	0.43		
BMI, Kg/m^2	1.03 (0.95–1.13)	0.43		
Previous abdominal surgery	0.94 (0.38–2.34)	0.89		
ASA (1/2 vs 3)	0.90 (0.30–2.49)	0.85		
Surgical approach (lap vs open)	0.81 (0.21–3.91)	0.71		
Type of procedure (RC vs wedge)	1.31 (0.46–4.33)	0.63		
Operative time, min	1.01 (1.00–1.02)	0.01	1.01 (1.00–1.02)	**0.02**

BMI, body mass index (Kg/m^2); ASA, American Society of Anesthesiologists; lap, laparoscopy; RC, right colectomy.

colonoscopy prolongs operative time and necessitates mechanical bowel preparation. Also, opposite to American and English surgeons that usually perform colonoscopy themselves, French digestive surgeons have limited experience with endoscopy. In the present series, one patient was converted to right colectomy because the frozen section suspected the presence of an invasive adenocarcinoma. Final pathology, however, showed a pTis lesion and cecal wedge would be adequate treatments.

A number of authors recommend laparoscopically assisted colonoscopic polypectomy (LACP).[17,18] In this approach, the affected bowel segment is first mobilized laparoscopically, and polypectomy performed endoscopically under laparoscopic control or through a small colotomy. The only available randomized controlled trial comparing LACP with laparoscopic right colectomy did not show any difference in complication rates, although, as expected, LACP resulted in a significantly shorter hospital stay.[18] Moreover, the ability of LACP to adequately retrieve difficult polyps is limited by a number of factors mostly related to location, for example, the proximity of the polyp to the appendix lumen and/or the ileocecal valve.[18] Also, colotomy exposes the patient to an increased risk of organ-space surgical site infection or peritoneal dissemination of cancer, should it be present.[18] Finally, unlike cecal wedge resection, because of the risk of potential recurrence of polyps, surveillance colonoscopy is necessary.[19–21]

One possible disadvantage of cecal wedge resection is that an additional procedure will be required in the event an invasive cancer is found on final pathologic examination. Factors commonly associated with malignancy include left side location,[22,23] villous architecture,[24] high-grade dysplasia,[22–24] and advanced patient age.[24] Therefore, the risk of unsuspected malignancy in cecal polyps, and particularly those adjacent to the appendix orifice, is likely to be lower than typically observed in endoscopically unresectable lesions.

Degenerated polyps can be treated successfully by endoscopic resection in case of Tis adenomas. For pT1 adenocarcinomas (submucosal invasion), endoscopic resection alone is considered enough only if various criteria are fulfilled, including complete endoscopic excision, submucosal invasion $< 1000\,\mu m$ if sessile or flat lesion or limited to the upper one-third of the polyp stalk if pedunculated (Haggitt 1, 2 and some Haggitt 3), lesion-free resection margins, well or moderate differentiation of the cancer cells, no lymphatic or venous invasion, and the absence of budding.[25] In the absence of one of the above criteria, salvage surgery is highly advisable. However, Benhaim et al[26] showed that salvage surgery was performed in nearly three-quarters of patients because of a resection margin of $< 1\,mm$. Indeed the main indication for salvage surgery was thus more technical than pathological in most patients. Herein, cecal wedge resection allows for an adequate histopathology report and would be able to avoid unnecessary radical surgery.

Endoscopic resection of cecal polyps involving the appendix orifice is challenging. Several reasons have been pointed out, such as the narrowness of the appendix orifice lumen that hampers clear observation of the lateral margin of the tumor, the technical difficulty to obtain a vertical approach to the lesion with endoscopic devices, which indeed carries a high risk of perforation, and the

absence of a muscle layer, which increases the risk of complications.[27] Song et al[28] published a large series of endoscopic resections involving the appendix orifice. Complete resection rate was barely 68%, bleeding occurred in 13% of patients, and the perforation rate was 10.5%. Moreover, for polyps larger than 20 mm, piecemeal resection was needed in ± 50%, whereas recurrence (± 20%) and complications (39%) were frequent.[28] Noteworthy, the presence of adenocarcinoma invading the submucosa was extremely rare (< 1%).[28]

A recently published systematic review on the outcomes of surgical resection for benign colon polyps found a substantial risk of postoperative morbidity (24%), severe complications (0% to 10.1%), and surgical reinterventions (0% to 8.9%), which are most likely related to the extent of surgical resection and patients' characteristics, rather than specific polyp features.[19] A recently published snapshot study from the European Society of Coloproctology found 70.4% anastomotic leak, 38% morbidity, and 20.4% mortality rate after right colectomy, which contradicts the common belief that this procedure is the "simplest" colorectal major one.[29]

Functional outcome after rectal resection has been well described but these results are not transferable to patients undergoing colonic resection because different pathophysiological mechanisms are probably responsible for functional disorders after colonic resection,[30–32] such as the reduced capacity of water absorption or the reduced absorption of biliary acids or bacterial growth in the ileum in the case of resection of the ileocecal valve in right-side colectomies. Moreover, functional outcomes are directly related to experienced quality of life and patients undergoing colon resection frequently request to be fully informed about the expected functional outcomes.[30,32,33]

Surgical removal of the ileocecal valve may hamper gastrointestinal function.[32,33] Magdeburg et al[31] showed that almost half of the patients after right-side resection complained of liquid stool more than once per month, which was significantly higher than after a left-side resection. In the study from Ohigashi et al[33] patients undergoing right colectomy exhibited tendency toward soft stool, higher frequency of nighttime defecation, and decreased quality of life score compared with those undergoing left colectomy. Noteworthy, symptoms related to poorer quality of life were still present more than 2 years after surgery.[33]

Our study has some drawbacks mostly related to its retrospective nature. Both groups were not completely homogeneous since right-side colectomy was performed for larger polyps and 20% of patients had an invasive component, however, it probably does not interfere with the primary (morbidity) and secondary (operative time and hospital stay) endpoints. Also, colonoscopy reports were unavailable and although polyp size measurement at colonoscopy is usually well correlated with the pathologic size measurement,[22] we did not have access to a detailed description of the polyp surface and morphology, and whether or not polyps were assessed with advanced imaging techniques.[19] Finally, functional outcomes could not be evaluated. However, it is well-grounded to think that cecal wedge resection is associated with better functional outcomes since it does not modify the gastrointestinal anatomy.

CONCLUSION

For benign polyps it is widely accepted that oncologic colectomy is deemed to be overtreatment with a non-negligible rate of major complications, mortality, and functional sequelae.[22,23,33] Thus, for benign-appearance polyps, cecal wedge should be considered an attractive option, for as much it allows complete transmural resection and consequently precise pathology report while it allows ileocecal valve sparing, colon preservation, and acceptable surgical morbidity.

References:

1. Siegel RL, Ward EM, Jemal A. Trends in colorectal cancer incidence rates in the United States by tumor location and stage, 1992–2008. *Cancer Epidemiol Biomarkers Prev*. 2012;21(3):411–416.

2. Markowitz AJ, Winawer SJ. Management of colorectal polyps. *CA Cancer J Clin*. 1997;47(2):93–112.

3. Nusko G, Mansmann U, Altendorf-Hofmann A, Groitl H, Wittekind C, Hahn EG. Risk of invasive carcinoma in colorectal adenomas assessed by size and site. *Int J Colorectal Dis*. 1997; 12(5):267–271.

4. Zauber AG, Winawer SJ, O'Brien MJ, et al. Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. *N Engl J Med*. 2012;366(8):687–696.

5. Sidhu M, Tate D, Desomer L, et al. The size, morphology, site, and access score predicts critical outcomes of endoscopic mucosal resection in the colon. *Endoscopy*. 2018;50(7):684–692.

6. Hassab TH, Church JM. Appendix orifice polyps: a study of 691 lesions at a single institution. *Int J Colorectal Dis*. 2019; 34(4):711–718.

7. Ngamruengphong S, Pohl H, Haito-Chavez Y, Khashab MA. Update on difficult polypectomy techniques. *Curr Gastroenterol Rep*. 2016;18(1):3.

8. Church JM. Experience in the endoscopic management of large colonic polyps. *ANZ J Surg.* 2003;73(12):988–995.

9. Benedix F, Köckerling F, Lippert H, Scheidbach H. Laparoscopic resection for endoscopically unresectable colorectal polyps: analysis of 525 patients. *Surg Endosc.* 2008;22(12): 2576–2582.

10. McDonald JM, Moonka R, Bell RH. Pathologic risk factors of occult malignancy in endoscopically unresectable colonic adenomas. *Am J Surg.* 1999;177(5):384–387.

11. Jang JH, Balik E, Kirchoff D, et al. Oncologic colorectal resection, not advanced endoscopic polypectomy, is the best treatment for large dysplastic adenomas. *J Gastrointest Surg.* 2012;16(1):165–172.

12. Adrales GL, Harold KL, Matthews BD, Sing RF, Kercher KW, Heniford BT. Laparoscopic "radical appendectomy" is an effective alternative to endoscopic removal of cecal polyps. *J Laparoendosc Adv Surg Tech A.* 2002;12(6):449–452.

13. Kulaylat AS, Boltz MM, Moyer M, Mathew A, McKenna K, Messaris E. Management of large cecal polyps: when can the ileocecal valve be spared.? *Dis Colon Rectum.* 2018;61(9):1089–1095.

14. Dindo D, Demartines N, Clavien P-A. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg.* 2004;240(2):205–213.

15. Floyd TL, Orkin BA, Kowal-Vern A. Cecal wedge resection appendectomy for the management of appendiceal polyps. *Tech Coloproctol.* 2016;20(11):781–784.

16. Giavarini L, Boni L, Cortellezzi CC, et al. Laparoscopic caecal wedge resection with intraoperative endoscopic assistance. *Int J Surg.* 2013;11(Suppl 1):S58–S60.

17. Wilhelm D, von Delius S, Weber L, et al. Combined laparoscopic-endoscopic resections of colorectal polyps: 10-year experience and follow-up. *Surg Endosc.* 2009;23(4):688–693.

18. Lascarides C, Buscaglia JM, Denoya PI, Nagula S, Bucobo JC, Bergamaschi R. Laparoscopic right colectomy vs laparoscopic-assisted colonoscopic polypectomy for endoscopically unresectable polyps: a randomized controlled trial. *Colorectal Dis.* 2016;18(11):1050–1056.

19. de Neree tot Babberich MPM, Bronzwaer MES, Andriessen JO, et al. Outcomes of surgical resections for benign colon polyps: a systematic review. *Endoscopy.* 2019;51(10):961–972.

20. Hassan C, Repici A, Sharma P, et al. Efficacy and safety of endoscopic resection of large colorectal polyps: a systematic review and meta-analysis. *Gut.* 2016;65(5):806–820.

21. Ramirez M, Schierling S, Papaconstantinou HT, Thomas JS. Management of the malignant polyp. *Clin Colon Rectal Surg.* 2008;21(4):286–290.

22. Gorgun E, Benlice C, Church JM. Does cancer risk in colonic polyps unsuitable for polypectomy support the need for advanced endoscopic resections.? *J Am Coll Surg.* 2016; 223(3):478–484.

23. Bertelson NL, Kalkbrenner KA, Merchea A, et al. Colectomy for endoscopically unresectable polyps: how often is it cancer? *Dis Colon Rectum.* 2012;55(11):1111–1116.

24. 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(7):1017–1022.

25. Thesaures National de Cancerlogie Digestive, https://www.snfge.org/sites/default/files/SNFGE/TNCD/tncd_chap-03-cancer-colon-non-metastatique_2019-01-21.pdf.

26. Benhaim L, Benoist S, Bachet JB, Julié C, Penna C, Nordlinger B. Salvage colectomy for endoscopically removed malignant colon polyps: is it possible to determine the optimal number of lymph nodes that need to be harvested? *Colorectal Dis.* 2012;14(1):79–86.

27. Sakamoto I, Watanabe S, Sakuma T, et al. Intramucosal adenocarcinoma of the appendix: how to find and how to treat. *Endoscopy.* 2003;35(9):785–787.

28. Song EM, Yang H-J, Lee HJ, et al. Endoscopic resection of cecal polyps involving the appendiceal orifice: a KASID multicenter study. *Dig Dis Sci.* 2017;62(11):3138–3148.

29. 2015 European Society of Coloproctology Collaborating Group. Predictors for anastomotic leak, postoperative complications, and mortality after right colectomy for cancer: results from an international snapshot audit. *Dis Colon Rectum.* 2020; 63(5):606–618.

30. Theodoropoulos GE, Papanikolaou IG, Karantanos T, Zografos G. Post-colectomy assessment of gastrointestinal function: a prospective study on colorectal cancer patients. *Tech Coloproctol.* 2013;17(5):525–536.

31. Magdeburg J, Glatz N, Post S, Kienle P, Rickert A. Long-term functional outcome of colonic resections: how much does faecal impairment influence quality of life? *Colorectal Dis.* 2016;18(11): O405–O413.

32. Palmisano S, Silvestri M, Troian M, Germani P, Giudici F, de Manzini N. Ileocaecal valve syndrome after surgery in adult patients: myth or reality? *Colorectal Dis.* 2017;19(8): e288–e295.

33. Ohigashi S, Hoshino Y, Ohde S, Onodera H. Functional outcome, quality of life, and efficacy of probiotics in postoperative patients with colorectal cancer. *Surg Today.* 2011; 41(9):1200–1206.