Clinics in Surgery

Research Article
Published: 08 Feb, 2021

J Pouch Excision due to Pouch Neoplasia after Ileal Pouch Anal Anastomosis in Ulcerative Colitis Patients. Analysis of Nine Pouch Neoplasia Patients and Review of the Literature

Adam Bobkiewicz, Maciej Borejsza-Wysocki, Maciej Konopka, Tomasz Banasiewicz and Lukasz Krokowicz*

Department of General, Endocrinological Surgery and Gastroenterological Oncology, Poznan University of Medical Sciences, Poland

Abstract

Purpose: Ileal Pouch-Anal Anastomosis (IPAA) is the procedure of choice in Ulcerative Colitis (UC) patients or Familial Adenomatous Polyposis (FAP). Pouch neoplasia is a rare long-term pouch complication. We present an analysis of nine patients after pouch excision due to the pouch dysplasia or cancer.

Methods: Retrospectively patients who underwent IPAA between 1985 and 2009 were analyzed. Data of patients qualified for pouch excision were analyzed such as: gender, age, duration of UC before IPAA, presence of neoplasia in the colectomy specimen the location of the pouch neoplasia and others. Patient was qualified for pouch excision based on histopathological examination, endoscopic and imaging studies and clinical evaluation. Abdominoperineal resection in association with pouch excision with permanent ileostomy was the standard management in diagnosis of pouch neoplasia.

Results: A total of 276 patients who underwent the IPAA procedure were analyzed. Nine patients developed pouch neoplasia. The mean age at the time of pouch excision was 46.2 ± 7.9 years (range: 38 to 62 years). The mean duration of ulcerative colitis prior to IPAA was 18.8 ± 7.9 years (range: 2 to 28), while the time between IPAA and pouch neoplasia was 13.2 ± 5.8 (range: 5 to 20). Seven patients diagnosed with pouch neoplasia had showed neoplasia in the colorectal specimen. Abdominoperineal resection in association with pouch excision with permanent ileostomy was performed in nine patients. There were no major postoperative complications.

Conclusion: The prevalence of neoplasia in the pouch is rare. Strict postoperative endoscopic surveillance in this group of patients may allow for early stage detection of neoplastic changes. It is highly important to create IPAA patient databases in order to monitor the effectiveness of treatment.

Keywords: Pouch neoplasia; Pouch excision; Restorative proctocolectomy; Ulcerative colitis

OPEN ACCESS

Correspondence:
Lukasz Krokowicz, Department of General, Endocrinological Surgery and Gastroenterological Oncology, Poznan University of Medical Sciences, Przybyszewskiego 49, 60-355 Poznan, Poland, Tel: +48 618 691 122; Fax: +48 618 691 684;
E-mail: lkrokowicz@gmail.com

Received Date: *07 Dec 2020*
Accepted Date: *22 Jan 2021*
Published Date: *08 Feb 2021*

Citation:
Bobkiewicz A, Borejsza-Wysocki M, Konopka M, Banasiewicz T, Krokowicz L. J Pouch Excision due to Pouch Neoplasia after Ileal Pouch Anal Anastomosis in Ulcerative Colitis Patients. Analysis of Nine Pouch Neoplasia Patients and Review of the Literature. Clin Surg. 2021; 6: 3051.

Introduction

Ileal-Pouch Anal Anastomosis (IPAA) is the procedure of choice in Ulcerative Colitis (UC) patients or Familial Adenomatous Polyposis (FAP). However, this procedure is associated with both short- and long-term pouch complications. The most common pouch-related complications include pouchitis, stenosis of the Ileal-Pouch Anal Anastomosis (IPAA), and cuffitis. Pouch failure affects 10% to 15% of patients in the period of 20 years following IPAA [1]. Pouch neoplasia is a rare long-term pouch complication and may be attributed by Low-Grade Dysplasia (LGD), High-Grade Dysplasia (HGD), or Colorectal Cancer (CRC) and be localized at the Anal Transitional Zone (ATZ), residual rectal mucosa or in the pouch body.

The first pouch dysplasia after IPAA was described in 1991 [2]. Since then, the numbers of patients diagnosed with dysplasia or pouch cancer have been described due to the long follow-up period and the changes in some surveillance strategies in patients after IPAA.

It was clearly estimated, that colectomy does not completely eliminate the risk for pouch neoplasia [3]. In general, the overall pouch cancer risk following RPC with IPAA is still unknown

Table 1: Type of surgeries in UC patients qualified for restorative proctocolectomy.

Type of RPC	Elective	Urgent	Total
Two-stageprocedure	178	28	206
Three-stageprocedure	6	64	70
Total	184	92	276

[4]. However, recently Selvaggi et al. [5] indicated neoplasia on large bowel specimen as a significant risk factor for pouch neoplasia what is in line with our recent outcomes [6]. The occurrence of pouch neoplasia is a serious diagnostic and therapeutic problem. Firstly, foci of dysplasia may be masked or difficult to verify unambiguously, mainly due to the refractory or chronic pouchitis [7]. Secondly, in pouch dysplasia and early pouch cancer usually patients do not present any clinical symptoms. Thirdly, some pouch mucosal changes are difficult to be diagnosed as either negative or positive for dysplasia [8].

In 2007, Scarpa et al. [9] reported on 22 patients diagnosed with pouch cancer, whereas in 2011, Liu et al. [10] described 42 patients with pouch cancer.

In the present study, we present an analysis of nine patients after pouch excision due to the pouch dysplasia or cancer. Due to the lack of firm conclusions regarding risk factors, courses of the dysplasia and a small number of patients diagnosed with pouch dysplasia or cancer, there is the need for creation databases and exchange experiences in the field of surveillance concepts and strategies in UC patients after IPAA.

Materials and Methods

This study was conducted in the tertiary reference centre and approved by the Ethical Review Board of The Poznan University of Medical Sciences.

Retrospectively 276 patients who underwent IPAA between 1985 and 2009 were analyzed. The analysis included patients who met the following criteria: 1) age >18 years at the time of operation; 2) performing IPAA due to UC; 3) J configuration of the pouch; 4) available regular endoscopic evaluation of the J pouch following IPAA.

Data of patients qualified for pouch excision due to pouch neoplasia were analyzed for: Gender, age, duration of UC before IPAA, presence of dysplasia/cancer foci in the colectomy specimen, type of IPAA anastomosis (manual versus stapler), presence of Primary Sclerosing Cholangitis (PSC) - the time between IPAA and diagnosis of pouch dysplasia/cancer as well as the location of the pouch neoplasia.

The IPAA procedure was performed in two or three stages, depending on the indication for surgery, its urgency, comorbidities or the history of steroid regimen. Depending on the indication for surgery, patients underwent emergency or elective surgery. As a standard, all patients have a J pouch configuration with 2 linear staplers (pouch length 12 cm to 16 cm). The ileal pouch was constructed and anastomosed to the anal stump using stapled technique or by hand suturing.

Following the IPAA, endoscopic evaluation of the ileal pouch was performed routinely at least once every second year and biopsy was taken in case of any alterations in mucosal pattern of the pouch. Endoscopic evaluation was performed using a rectoscope depending on the diameter of the IPAA anastomosis. Routinely, biopsy was collected from ileal pouch and IPAA anastomosis. Independently two histopathologists analyzed the biopsies.

Patient was qualified for pouch excision based on histopathological examination, endoscopic and imaging studies and clinical evaluation. In LGD patient endoscopic management was introduced as a method of choice. Abdominoperineal resection in association with pouch excision with permanent ileostomy was the standard management in diagnosis of pouch neoplasia.

The outcomes are presented as mean value and standard deviation. Statistical analysis was performed using Statistica 10 (StatSoft, Inc. Tulsa, USA).

Results

A total of 276 patients who underwent the IPAA procedure in the years 1985 to 2009 were included into the analysis. The study group comprised 46.1% (n=127) woman and 53.9% (n=149) man. The mean age at the time of IPAA was 43.2 ± 11.9 years.

Most of the patients underwent elective surgery (n=184), while the urgent colectomy was performed in 92 patients. The dominant strategy was the two-stage procedure, which was performed in 206 patients, while the three-stage procedure was performed in 70 patients (Table 1).

Nine patients following IPAA developed dysplasia or cancer during postoperative surveillance (Table 2). Pouch dysplasia or cancer was diagnosed in six women (n=6) and three men (n=3). The

Table 2: Characteristics of patients with pouch neoplasia.

Patient No	Type of pouchneoplasia	Location of pouch neoplasia	Age at the time of RPC	Gender	Time of UC before RPC (years)	Neoplasia in colorectal specimen	Type of IPAA	Time between RPC and pouch neoplasia (years)	PSC
1	LGD	NA	47	F	28	HGD	Stapled	12	No
2	HGD	body pouch	40	M	19	HGD	Stapled	14	No
3	LGD	body pouch	46	M	28	CRC	Stapled	18	NA
4	CRC	body pouch	38	F	21	CRC	Hand-sewn	20	NA
5	HGD	body pouch	39	M	21	LGD	Stapled	16	No
6	HGD	NA	42	F	20	HGD	Hend-sewn	20	NA
7	CRC	ATZ	47	F	12	No	Stapled	5	No
8	LGD	ATZ	55	F	2	LGD	Stapled	6	No
9	LGD	ATZ	62	F	18	No	Stapled	8	No

LGD: Low Grade Dysplasia; HGD: High Grade Dysplasia; CRC: Colorectal Cancer; NA: Not Available; UC: Ulcerative Colitis; IPAA: Ileal-Pouch Anal Anastomosis; PSC: Primary Sclerosing Chilangitis; ATZ: Anal Transitional Zone

Table 3: Summary of patients diagnosed with pouch neoplasia in the latest 20 years in the literature.

Reference	No of patients	Time of UC duration (years)	Time between RPC and pouch neoplasia	Age at the time of pouch neoplasia diagnosis	% pouchneoplasia
Kariv et al. [23]	3203	NA	NA	NA	0.005
Pishori et al. [31]	303	9.2 ± 9	40 mo (median)	NA	0.007
O'Riordain et al. [32]	210	7.2 (median)	77 mo (median)	NA	LGD - 2.9%
					HGD - 0.5%
Remzi et al. [19]	178	NA	130 mo	NA	LGD - 3.4%
					HGD - 1.1%
Herline et al. [33]	160	NA	8.4 ± 4.6 yrs	NA	0.006
Thompson-Fawcett et al. [34]	113	10.1 (median)	2.5 yrs	70	0.009
Coull et al. [35]	110	8.8 (median)	56 mo	NA	0
Bobkiewicz et al. [6]	276	18.8 ± 7.9	13.2 ± 5.8 yrs	46.2 ± 7.9	LGD - 0.01%
					HGD - 0.01%
					Ca - 0.007%

LGD: Low Grade Dysplasia; HGD: High Grade Dysplasia; NA: Not Available; UC: Ulcerative Colitis; Ca: Pouch Carcinoma

mean age at the time of pouch excision was 46.2 ± 7.9 years (range: 38 to 62 years). The mean duration of ulcerative colitis prior to IPAA was 18.8 ± 7.9 years (range: 2 to 28), while the time between IPAA and pouch neoplasia was 13.2 ± 5.8 (range: 5 to 20).

Seven patients underwent stapled pouch construction and IPAA (n=7), while in the remaining two hand sewn anastomoses were performed.

Abdominoperineal resection in association with pouch excision with permanent ileostomy was performed in nine patients. In HGD patient, the attempt of local excision was performed with the recurrence of HGD loci in the consecutive endoscopic biopsy. Thus, an indication for pouch excision in HGD was straightforward. In LGD patients multifocal flat LGD or DALM were diagnosed with no response for endoscopic management. Additionally, three LGD patients suffered from chronic refractory pouchitis associated with functional complications of the pouch for long period of time what influenced on the final diagnosis for pouch excision.

Seven patients diagnosed with pouch neoplasia had showed dysplasia or cancer in the colorectal specimen during RPC (LGD - two patients; HGD - three patients; CRC - two patients).

There were no major postoperative complications. The perineal wound healed uneventfully in five patients. In remaining three patients surgical site infection was diagnosed and treated with negative pressure wound therapy with good outcomes.

Discussion

It was in 1978 when Parks and Nicholls introduced a new concept of surgical management in UC patients required colectomy [11]. Since then, IPAA had was a method of choice in this group of patient with the J-shape of ileal pouch as the most common used in surgical practice. According to recent ileo-anal pouch report based on analysis of 5352 pouch operations, J-pouch configuration was used in 99% of patients using a stapled technique in 90% of IPAA [12]. From technical point of view, J pouch construction is estimated to be easier to perform in contrast to the S or W pouch configuration, requires a shorter segment of the small intestine and is associated with a lower postoperative complication rate [13]. Nevertheless, the J pouch may be the source of many potential complications, that usually are classified into: structural (e.g., IPAA stenosis), inflammatory (e.g., pouchitis or comfits), and functional (e.g., irritable pouch syndrome).

Based on recent studies, 10% to 15% of UC patients after IPAA required pouch excision during long-term follow-up [14]. Independently, Prudhomme et al. [15] and Tulchinsky et al. [16] analyzed patients qualified for the pouch excision, indicated Crohn's disease patients (n=14) as the most common underlying disease for pouch failure. In general, approximately 40% to 50% of all pouch failure occurred in patients diagnosed with Crohn's disease [17,18].

The prevalence of pouch neoplasia is very rare. However, due to the increasing time of follow-up, the greater numbers of publications regarding pouch neoplasia have been observed. Remzi et al. [19] reported that the cumulative incidence rate of pouch neoplasia after IPAA was 1.3% and 4.2% at 10 and 20 years after the RPC, respectively. Liu et al. [10] reported that the cumulative incidence rate of neoplasia 0.8%, 1.3%, 1.5%, 2.2% and 3.2% at 5, 10, 15, 20 and 25 years, respectively.

Creation patient's database after IPAA and the exchange of experiences may allow for the assessment for risk factors of pouch neoplasia that may influence on the changes in long-term strategy and surveillance.

Despite that today IPAA is a gold standard for UC in some situation IRA (Ileorectal Anastomosis) may be a better solution for selected patients where they meet the following requirements: Normal sphincter tone, absence of severe perineal disease, rectum does not actively involve by the disease, absence of dysplasia or cancer.

It may also indicate in young fertile women, because it reduces the risk of infertility. In this group of patients risk of cancer is higher and they have to be informed about follow-up responsibility with annual endoscopy with rectal biopsies.

In general, the overall pouch cancer risk following RPC with IPAA is still unknown [4]. However, presence of colorectal dysplasia or CRC in colectomy specimen is a well- defined risk factor for pouch neoplasia [20].

Derikx et al. [21] revealed that CRC or colon dysplasia increased the risk for pouch neoplasia 25- and 4- fold, respectively. In our previous study, we also indicated the presence of neoplasia in the colorectal specimen may increase the risk of pouch neoplasia [6]. Moreover, we showed that the presence of chronic and refractory

pouchitis and the presence of CRC or dysplasia in the colon specimen were independent risk factors for the development of pouch neoplasia [22-26]. Thus; there is the need for routine surveillance pouchoscopy in high-risk patients, especially those diagnosed with preoperative colitis-associated neoplasia. LGD is the most common form of pouch neoplasia. The diagnosis of pouch dysplasia is based on assessment of both architectural alterations and cytologic abnormalities [8]. Although, some LGD has a tendency for relapsing, the risk for progression to HGD or pouch cancer is possible [27]. Van Schaik et al. [28] indicated a 5-year progression rate to advanced pouch neoplasia in 37% of patients diagnosed with LGD. Moreover, it was revealed that both LGD and HGD, may progressed into adenocarcinoma, that was stated in many studies [29,30]. Pouchoscopy with biopsy is the current gold standard for postoperative surveillance [31-36]. Conventional white-light endoscopy supported with narrow banding imaging or chromo endoscopy should improve the detection of pouch neoplasia at early stage [3,37]. It is recommended to take at least six biopsies from every part of pouch-ATZ, cuff, pouch body and afferent limb. However, diagnostic accuracy of pouch endoscopy seems to be still a suboptimal. Based on recent data, 8 of 10 patients diagnosed with HGD were missed with endoscopic detection at the LGD stage [10]. Moreover, in the group of pouch adenocarcinoma, three patients (27%) had no lesions detected endoscopically [23]. Thus, there is still the need for looking for optimal endoscopic surveillance in this group of patients.

Recently, many other factors were analyzed as risk factors for pouch neoplasia. A family history of CRC, Primary Sclerosing Cholangitis (PSC), and a long duration of UC were revealed as purported risk factors [3,24]. Branco et al. [25] also indicated a long duration of UC as a risk factor for pouch neoplasia. In the present study, the mean duration of UC before IPAA in the group of patients who finally underwent pouch excision due to pouch neoplasia was 18.8 ± 7.9.

Previously, concomitant PSC was indicated as a risk factor for colorectal neoplasia in UC patients [26]. However, currently there is no firm conclusion that PSC increases the risk for pouch neoplasia. Our results are in the line with Kariv et al. [23] showing that PSC was not shown to be a risk factor for pouch neoplasia.

Another interesting observation is that the microbiome is implicated as a factor in inflammatory and perhaps neoplastic changes as well. Bacterial dysbiosis may predispose individuals to pouchitis after IPAA surgery and thus to dysplasia [38].

Natural modification of the microbiome by dietary factors such as short-chain fatty acids produced by a bacteria living in the large intestine which are them a in energy substrate for the colonocytes. Butyric acid is used for the treatment and prevention of exacerbations of various gastrointestinal diseases: Diarrhea, intestinal inflammations, functional disorders, dyspoiesis, and post-surgery or post-chemotherapy conditions and thus may inhibit neoplasm proliferation [39].

Compared to the data presented by other authors, we showed a longer duration of UC before IPAA as well as between the IPAA and the diagnosis of pouch neoplasia (Table 3). The discrepancy in the reported prevalence in our material may result from many reasons. Firstly, it is due to the incomplete institution endoscopic database. Secondly, despite the facts that IPAA was performed at the authors' center, in some patient send as copy surveillance was carried out at other reference centers. Thirdly, the lack of a registry of IPAA patients in Poland means that important clinical data and the intense surveillance are missed. Moreover, there are differences in patient population and sample size, study design, and pouch surveillance.

Taking into account the risk of neo, as well as other complications, patients qualified for the IPAA should be clearly informed about the surgical procedure, need of follow up and possibility of future surgical treatment. This may result in creation of a group of patients who, being aware of the potential complications of IPAA, consider permanent stoma and APR as a final procedure.

Conclusion

Despite potential both early and late complications, restorative proctocolectomy remains the gold standard of surgical treatment in UC patients. The occurrence of neoplasia in the pouch is rare. However, due to increased follow-up period of time after IPAA, an increased number of UC patients are diagnosed with pouch neoplasia.

Determination of the patients with high risk of pouch malignancy may be important in decision of surgery type-possibility of preventive APR.

Regular endoscopy with standardized protocol (chromo endoscopy) is very important in high risk patients. Diet modifications and individual microbiome modification can be important but require more detailed evaluation. It is highly important to create IPAA patient databases in order to monitor the effectiveness of treatment. Strict postoperative endoscopic surveillance in this group of patients may allow for early stage detection of neoplastic changes.

References

1. Landy J, Al-Hassi HO, McLaughlin SD, Knight SC, Ciclitira PJ, Nicholls RJ, et al. Etiology of pouchitis. Inflamm Bowel Dis. 2012;18(6):1146-55.
2. Löfberg R, Liljeqvist L, Lindquist K, Veress B, Reinholt FP, Tribukait B. Dysplasia and DNA aneuploidy in a pelvic pouch. Report of a case. Dis Colon Rectum. 1991;34(3):280-3; discussion 283-4.
3. Khan F, Shen B. Inflammation and neoplasia of the pouch in inflammatory bowel disease. Curr Gastroenterol Rep. 2019;21(4):10.
4. Mark-Christensen A, Erichsen R, Brandsborg S, Rosenberg J, Qvist N, Thorlacius-Ussing O, et al. Long-term risk of cancer following ileal pouch-anal anastomosis for ulcerative colitis. J Crohns Colitis. 2018;12(1):57-62.
5. Selvaggi F, Pellino G, Canonico S, Sciaudone G. Systematic review of cuff and pouch cancer in patients with ileal pelvic pouch for ulcerative colitis. Inflamm Bowel Dis. 2014;20(7):1296-308.
6. Bobkiewicz A, Krokowicz L, Paszkowski J, Studniarek A, Szmyt K, Majewski J, et al. Large bowel mucosal neoplasia in the original specimen may increase the risk of ileal pouch neoplasia in patients following restorative proctocolectomy for ulcerative colitis. Int J Colorectal Dis. 2015;30(9):1261-6.
7. Das P, Johnson MW, Tekkis PP, Nicholls RJ. Risk of dysplasia and adenocarcinoma following restorative proctocolectomy for ulcerative colitis. Colorectal Dis. 2007;9(1):15-27.
8. Gonzalo DH, Collinsworth AL, Liu X. Common inflammatory disorders and neoplasia of the ileal pouch: A review of histopathology. Gastroenterology Res. 2016;9(2-3):29-38.
9. Scarpa M, vanKoperen PJ, Ubbink DT, Hommes DW, Ten Kate FJ, Bemelman WA. Systematic review of dysplasia after restorative proctocolectomy for ulcerative colitis. Br J Surg. 2007;94(5):534-45.
10. Liu ZX, Kiran RP, Bennett AE, Ni RZ, Shen B. Diagnosis and management

of dysplasia and cancer of the ileal pouch in patients with underlying inflammatory bowel disease. Cancer. 2011;117(14):3081-92.

11. Parks AG, Nicholls RJ. Proctocolectomy without ileostomy for ulcerative colitis. Br Med J. 1978;2(6130):85-8.

12. Worley GHT, Fearnhead NS, Brown SR, Acheson AG, Lee MJ, Faiz OD. Review of current practice and outcomes following ileoanal pouch surgery: Lessons learned from the Ileoanal Pouch Registry and the 2017 Ileoanal Pouch Report. Colorectal Dis. 2018;20(10):913-22.

13. Khan F, Shen B. Complications related to J-Pouch surgery. Gastroenterol Hepatol (NY). 2018;14(10):571-6.

14. Helavirta I, Kirsi L, Huhtala H, Hyöty M, Collin P, Aitola P. Pouch failures following restorative proctocolectomy in ulcerative colitis. Int J Colorectal Dis. 2020;35(11):2027-33.

15. Prudhomme M, Dehni N, Dozois RR, Tiret E, Parc R. Causes and outcomes of pouch excision after restorative Proctocolectomy. Br J Surg. 2006;93(1):82-6.

16. Tulchinsky H, Hawley PR, Nicholls J. Long-term failure after restorative proctocolectomy for ulcerative colitis. Ann Surg. 2003;238(2):229-34.

17. Sagar PM, Dozois RR, Wolff BG. Long-term results of ileal pouch–anal anastomosis in patients with Crohn's disease. Dis Colon Rectum. 1996;39:893-8.

18. Hyman NH, Fazio VW, TucksonWB, Lavery IC. Consequences of ileal pouch–anal anastomosis for Crohn's colitis. Dis Colon Rectum. 1991;34:653-7.

19. Remzi FH, Fazio VW, Delaney CP, Preen M, Ormsby A, Bast J, et al. Dysplasia of the anal transitional zone after ileal pouch-anal anastomosis: Results of prospective evaluation after a minimum of ten years. Dis Colon Rectum. 2003;46(1):6-13.

20. Althumairi AA, Lazarev MG, Gearhart SL. Inflammatory bowel disease associated neoplasia: A surgeon's perspective. World J Gastroenterol. 2016;22(3):961-73.

21. Derikx LA, Kievit W, Drenth JP, de Jong DJ, Ponsioen CY, Oldenburg B, et al. Prior colorectal neoplasia is associated with increased risk of ileoanal pouch neoplasia in patients with inflammatory bowel disease. Gastroenterology. 2014;146(1):119-28.

22. Banasiewicz T, Marciniak R, Paszkowski J, Krokowicz P, Kaczmarek E, Walkowiak J, et al. Pouchitis may increase the risk of dysplasia after restorative proctocolectomy in patients with ulcerative colitis. Colorectal Dis. 2012;14(1):92-7.

23. Kariv R, Remzi FH, Lian L, Bennett AE, Kiran RP, Kariv Y, et al. Preoperative colorectal neoplasia increases risk for pouch neoplasia in patients with restorative proctocolectomy. Gastroenterology. 2010;139(3):806-12.

24. Wu XR, Remzi FH, Liu XL, Lian L, Stocchi L, Ashburn J, et al. Disease course and management strategy of pouch neoplasia in patients with underlying inflammatory bowel diseases. Inflamm Bowel Dis. 2014;20(11):2073-82.

25. Branco BC, Sachar DB, Heimann TM, Sarpel U, Harpaz N, Greenstein AJ. Adenocarcinoma following ileal pouch-anal anastomosis for ulcerative colitis: Review of 26 cases. Inflamm Bowel Dis. 2009;15(2):295-99.

26. Soetikno RM, Lin OS, Heidenreich PA, Young HS, Blackstone MO. Increased risk of colorectal neoplasia in patients with primary sclerosing cholangitis and ulcerative colitis: A meta-analysis. Gastrointest Endosc. 2002;56(1):48-54.

27. Ziv Y, Fazio VW, Sirimarco MT, Lavery IC, Goldblum JR, Petras RE. Incidence, risk factors, and treatment of dysplasia in the anal transitional zone after ileal pouch-anal anastomosis. Dis Colon Rectum. 1994;37(12):1281-5.

28. Van Schaik FD, Ten Kate FJ, Offerhaus GJ, Schipper ME, Vleggaar FP, van der Woude CJ, et al. Misclassification of dysplasia in patients with inflammatory bowel disease: consequences for progression rates to advanced neoplasia. Inflamm Bowel Dis. 2011;17(5):1108-16.

29. Hassan C, Zullo A, Speziale G, Stella F, Lorenzetti R, Morini S. Adenocarcinoma of the ileoanal pouch anastomosis: An emerging complication? Int J Colorectal Dis. 2003;18(3):276-8.

30. Heuschen UA, Heuschen G, Autschbach F, Allemeyer EH, Herfarth C. Adenocarcinoma in the ileal pouch: Late risk of cancer after restorative proctocolectomy. Int J Colorectal Dis. 2001;16(2):126-30.

31. Pishori T, Dinnewitzer A, Zmora O, Oberwalder M, Hajjar L, Cotman K, et al. Outcome of patients with indeterminate colitis undergoing a double-stapled ileal pouch-anal anastomosis. Dis Colon Rectum. 2004;47(5):717-21.

32. O'Riordain MG, Fazio VW, Lavery IC, Remzi F, Fabbri N, Meneu J, et al. Incidence and natural history of dysplasia of the anal transitional zone after ileal pouch-anal anastomosis: Results of a five-year to ten year follow-up. Dis Colon Rectum. 2000;43(12):1660-5.

33. Herline AJ, Meisinger LL, Rusin LC, Roberts PL, Murray JJ, Coller JA, et al. Is routine pouch surveillance for dysplasia indicated for ileoanal pouches? Dis Colon Rectum. 2003;46(2):156-9.

34. Thompson-Fawcett MW, Rust NA, Warren BF, Mortensen NJ. Aneuploidy and columnar cuff surveillance after stapled ileal pouch-anal anastomosis in ulcerative colitis. Dis Colon Rectum. 2000;43(3):408-13.

35. Coull DB, Lee FD, Henderson AP, Anderson JH, McKee RF, Finlay IG. Risk of dysplasia in the columnar cuff after stapled restorative proctocolectomy. Br J Surg. 2003;90(1):72-5.

36. Fornaro R, Casaccia M, Caristo G, Batistotti P, Di Maira L, Atzori G, et al. Elective surgery for ulcerative colitis, ileo-rectal anastomosisor restorative proctocolectomy An Update. Ann Ital Chir. 2019;90:565-73.

37. Tajika M, Tanaka T, Ishihara M, Hirayama Y, Oonishi S, Mizuno N, et al. Long-term outcomes of meta chronous neo plasms in the ileal pouch and rectum after surgical treatment in patients with familial adenomatous polyposis. Endosc Int Open. 2019;7(5):E691-8.

38. Schieffer KM, Wright JR, Harris LR, Deiling S, Yang Z, Lamendella R, et al. NOD2 genetic variants predispose one of two familial adenomatous polyposis siblings to pouchitis through microbiome dysbiosis. J Crohns Colitis. 2017;11(11):1393-7.

39. Banasiewicz T, Domagalska D, Borycka-Kiciak K, Rydzewska G. Determination of butyric acid dosage based on clinical and experimental studies - a literature review. Prz Gastroenterol. 2020;15(2):119-25.