

Clinical Research

## Delivery Mode after Ileal Pouch-Anal Anastomosis among Pregnant Women with Ulcerative Colitis

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### Abstract

**Objectives:** The appropriate and recommended delivery mode after ileal pouch-anal anastomosis (IPAA) for ulcerative colitis (UC) has not been sufficiently evaluated. This study was designed to compare the delivery outcomes associated with cesarean section (CS) and vaginal delivery (VD) after IPAA.

**Methods:** We conducted a questionnaire-based survey of female patients who underwent IPAA for UC between July 1987 and May 2018. Additionally, we reviewed clinical data and collected information regarding pouch function and postpartum complications.

**Results:** In total, 45 patients had 68 deliveries, including 64 CS deliveries and four VDs. Fecal incontinence worsened in seven patients, including six CS patients and one VD patient. The Wexner scores of these patients before and after delivery were  $5.4 \pm 0.4$  and  $14.8 \pm 1.0$ , respectively ( $p = 0.005$ ). Four patients in the CS group and one in the VD group ( $p = 0.32$ ) had increased stool frequency. Bowel obstructions developed during 11/64 (17.2%) deliveries, and one patient required surgical intervention. One patient with four VDs (three before IPAA and one after IPAA) developed vaginal fistula 5 months after the final VD. Information on episiotomies could not be obtained.

**Conclusions:** Pouch function can decline even after CS. Notably, bowel obstruction can develop after CS. However, we cannot recommend a particular delivery method after IPAA. Further analyses to elucidate the relationship between CS and postoperative complications or vaginal fistula and episiotomy in VDs should be conducted.

### Keywords

ulcerative colitis, ileal pouch-anal anastomosis, delivery mode, cesarean section, vaginal delivery

J Anus Rectum Colon 2021; 5(4): 419-425

### Introduction

Ulcerative colitis (UC) is a chronic idiopathic inflammatory disease that affects the colon and rectum, and it most often occurs during young adulthood[1]. It is characterized by relapsing and remitting mucosal inflammation, starting in the rectum and extending to proximal segments of the colon. Since its first description in 1978 by Parks and Nicholls, restorative proctocolectomy, which includes total proctocolec-

tomy with ileal pouch-anal anastomosis (IPAA), has become the standard surgical therapy for UC[2,3]. Because UC develops mainly at reproductive age, the effects of this disease on future pregnancies and delivery should be carefully considered during its clinical course[1,4].

Patients should consider undergoing IPAA before childbirth because of concerns regarding the development of poor pouch function comprising incontinence and increasing stool frequency, as well as obstetric injury, at the IPAA site, given

that healing after delivery is difficult. In 2007, Lepisto et al.[5] stated that cesarean section (CS) should be indicated on the basis of obstetric factors because complications during delivery are rare. Moreover, some cohort studies have suggested that vaginal delivery (VD) is safe after IPAA[6-8]. However, despite the similarity regarding pouch function between VD and CS after IPAA and although adverse events during CS and obstetric injury during VD were not evaluated sufficiently, a systematic review in 2017[4] and the current Canadian consensus statement[9] suggested that CS probably has advantages over VD because obstetric injuries can develop in VD patients after IPAA.

Although the previous IPAA is stated as a relative indication for CS[10], the guidelines of the European Crohn's Colitis Organization stated that the appropriate delivery mode should be determined together with gastroenterologists, surgeons, and obstetricians[11]. In an observational study published in the Cochrane Library, the incidence of CS after IPAA significantly increased because of recommendations from colorectal surgeons, although not from obstetricians[12]. Presently, although several clinical situations need multidisciplinary care, no international clinical guidelines regarding the delivery mode for women after IPAA have been proposed by gastroenterological or obstetrical societies. Furthermore, little information on the relationship between the mode and outcomes of delivery is available, and this relationship can be confusing for both doctors and patients[4,13].

Thus, to establish clear and precise recommendations for the delivery mode after IPAA in terms of the colorectal surgeon, a large number of cohort studies must be evaluated, considering that the systematic review in 2017[4] included only 250 CS deliveries and 25 VDs, with little clinical information. Before a multicenter study or further systematic review can be performed, we aimed to review the delivery outcomes and adverse events due to delivery after IPAA at our institution to elucidate what clinical information should be considered in the future.

## Methods

### *Patient selection*

The clinical records of the patients treated at our institution between July 1987 and May 2018 were retrospectively reviewed. We created a consecutive clinical database that included patient characteristics and surgical information from July 1987. We selected female patients who were younger than 40 years at the time of IPAA, who were younger than 60 years at the time of the survey, who delivered at our institution, and whose clinical course information was available in the institutional database.

### *Review of the clinical and questionnaire data*

We conducted a questionnaire survey for the above-selected patients. We contacted these patients by telephone or sent standardized questionnaires to collect information on the time of birth, type of delivery, reason for the final delivery mode selected, postpartum complications, and changes in pouch function just after the postpartum period, including stool frequency, fecal incontinence, and development of anal stricture or fistula. Additionally, we reviewed the clinical records twice to validate the responses to the questionnaire.

### *Definition of outcomes*

Regarding the number of bowel movements, a change was noted when the number per day changed by three or more from before to after delivery. Fecal incontinence was evaluated by using the Wexner score (Cleveland Clinic Incontinence Score)[14]. Bowel movements and pouch functions just after the postpartum period were evaluated using questionnaires. However, solid stool-related items were excluded from this assessment tool because patients never had solid stool after IPAA. Postpartum complications and anal stricture or fistula were defined as complications with a grade of 2 or higher according to the Clavien-Dindo classification system[15].

### *Outcomes*

The primary endpoints were the changes in fecal incontinence and stool frequency after delivery with medical treatments, which included antidiarrheal and probiotics, regardless of the delivery mode. The secondary endpoints were the complications that occurred during delivery and the anal condition, which included anal stricture and fistula after delivery.

### *Exclusion criteria*

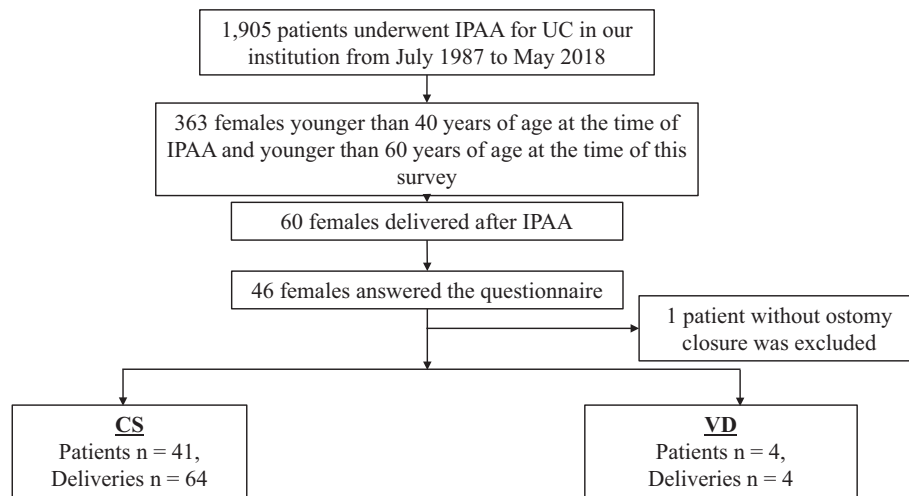
Patients who did not undergo ostomy closure after IPAA were excluded from this study. Patients who did not respond to the questionnaire survey were also excluded.

### *Statistical analysis*

All clinical data are presented as the means, and differences were assessed with the chi-squared test or Fisher's exact test. The Wilcoxon matched-pair test was used to test the significance of the change in the Wexner score from before to after delivery. A two-sided p value of <0.05 was considered statistically significant. JMP version 12 (SAS Institute Inc., Cary, NC, USA) was used to perform all analyses.

### *Ethics statement*

All study protocols were approved by the institutional review board at Hyogo College of Medicine (no. 3367), and informed consent and permission to use the patient data



**Figure 1.** Flowchart of the study selection process.

IPAA = ileal pouch–anal anastomosis, UC = ulcerative colitis, CS = cesarean section, VD = vaginal delivery

**Table 1.** Patient Characteristics.

	No. of all patients n = 45
Age (years)	43.0 (28–56)
Maternal age (years)	33.0 (23–45)
Interval from IPAA to delivery (years)	7.0 (0.4–17.9)
Follow-up after last delivery (months)	106 (3–245)
Number of deliveries after IPAA	1.0 (1–3)

IPAA = ileal pouch anal anastomosis

Continuous variables are indicated as medians and ranges.

**Table 2.** Reasons for Cesarean Section.

	No. of deliveries (n = 64)
Recommendation by doctor	36 (56.3)
Previous CS	21 (32.8)
Breech presentation	1 (1.6)
Placenta previa	1 (1.6)
Nonreassuring fetal status	1 (1.6)
Twins	1 (1.6)
Cephalopelvic disproportion	1 (1.6)
Advanced maternal age	1 (1.6)
Prolonged labor	1 (1.6)

CS = cesarean section

Number (percentage)

were obtained before surgery.

## Results

### Patient selection

Figure 1 shows the patient selection process for this study. Among 1,905 patients who underwent IPAA for UC in our institution, there were 363 females younger than 40 years at the time of IPAA and younger than 60 years at the time of the survey. Of these females, 60 were identified as having delivered after IPAA. The response rate to the questionnaire was 46/60 (76.7%). One patient in the CS group who had not undergone ostomy closure was excluded from the analysis.

### Patient characteristics and delivery

The patient characteristics are shown in Table 1. The median interval between the date of delivery and the date of this survey was 106 (range, 3–245) months. Two patients had an interval between delivery and the survey of 3 and 4 months. Their pouch function was not worsened. The re-

maining 43 patients had an interval between delivery and the survey of over 26 months. The median maternal age at delivery was 33 (range, 23–45) years (Table 1).

Forty-five patients had a total of 68 deliveries after IPAA during a median of 7.0 (range 0.4–17.9) years. The median individual number of deliveries after IPAA was 1.0 (range 1–3). After IPAA, 25, 17, and three patients had one, two, and three deliveries, respectively. Among them, 41 patients underwent 64 CSs, and four patients had VDs; one patient underwent CS two times and VD one time at the end of three gestations (Figure 1).

The incidence and clinical course of episiotomy and other complications could not be obtained sufficiently in this retrospective setting. No patient required surgical intervention during delivery.

### Reasons for CS

Table 2 shows the reasons for CS. The delivery mode was

**Table 3.** Postpartum Stool Frequency.

	Cesarean section n = 41	Vaginal delivery n = 4	p value
Increasing stool frequency	4 (9.8)	1 (25.0)	0.39
Increasing fecal incontinence	6 (14.6)	1 (25.0)	0.50

Categorical data presented as numbers (percentages).

**Table 4.** Timing of Postpartum Complications after Delivery.

Postdelivery interval	Small bowel obstruction in CS (n = 11/64)	Vaginal fistula in VD (n = 1/4)
<3 (months)	5 (45.5)	0
3–12 (months)	2 (18.2)	1
1–3 (years)	2 (18.2)	0
3–5 (years)	1 (0.1)	0
5–10 (years)	1 (0.1)	0

CS = cesarean section, VD = vaginal delivery

Categorical data are presented as numbers (percentages).

selected on the basis of the recommendation of the colorectal surgeon at our institution in 36 deliveries (56.3%), on the basis of having previously undergone CS in 21 deliveries (32.8%), and on the basis of the patient’s obstetric state in the remaining seven deliveries. Three patients decided to undergo VD on the basis of the surgeon’s opinion and personal preference. One patient underwent CS because of prolonged labor; however, her bowel function was not altered after delivery.

**Pouch function and postpartum complications**

Fecal incontinence worsened in seven patients, of whom, six had CSs and one had VD. In the CS group, six patients had fecal incontinence, and four had an increased stool frequency (Table 3). Among the other three patients in the VD group, there were no changes in defecation status before and after delivery, and the Wexner scores before and after delivery were  $4 \pm 0.34$  and  $5.29 \pm 0.59$ , respectively ( $p = 0.005$ ). The Wexner scores worsened in seven patients, indicating scores before and after delivery of  $5.4 \pm 0.4$  and  $14.8 \pm 1.0$ , respectively ( $p = 0.005$ ). Five patients, including four with CSs and one with VD, had fecal incontinence during both the day and night, and two CS patients had fecal incontinence during the night only.

The median stool frequency after delivery was 6 (range, 4-10) times per day in the CS group and 6 (5-12) in the VD group ( $p = 0.22$ ). There were four patients with an increased stool frequency in the CS group and one in the VD group ( $p = 0.39$ ). Their stool frequencies all increased after delivery. There were no significant differences in fecal incontinence or increased stool frequency between the CS and VD groups.

After CS, small bowel obstruction developed in eight of

the 41 (19.5%) patients who had undergone IPAA and CS. Bowel obstructions developed after 11/64 (17.2%) of the deliveries. Table 4 shows the timing of the postpartum complications after delivery. These complications developed in seven of 11 patients (63.6%) within 1 year after delivery. One patient required surgical intervention for bowel obstruction 3 years after CS. There were no clinical records of intestinal or other types of organ injuries during the CS procedure.

There was no other maternal or fetal mortality in this series.

In total, six patients were diagnosed with acute pouchitis after delivery; however, all of them recovered via treatment with antibiotics.

**Clinical course of a patient with vaginal fistula**

After VD in patients who had undergone IPAA, one patient who did not have pouchitis and was not diagnosed with Crohn’s disease developed vaginal fistula. She developed UC at the age of 33 years. IPAA without ileostomy was performed at 33 years of age because of refractory disease. Her clinical course after IPAA was eventful without any medications. She had four VDs at ages 27, 30, 31, and 37 years. She had three VDs before IPAA and one VD after IPAA. Information on episiotomy could not be obtained. Vaginal fistula developed 5 months after the last VD (4 years after IPAA). She required re-ostomy creation with simple stitch closure of fistula 1 year after VD after treatment failure with antibiotics. Finally, her vaginal fistula healed, and ostomy closure was performed 12 months later. Her clinical course was eventful without any recurrence of fistula during her 10 years of follow-up.

## Discussion

Remzi et al.[16] reported that among patients with UC who had undergone IPAA, the VD group had a significantly higher incidence of an anterior sphincter defect with a lower squeeze anal pressure than did the CS group. Moreover, quality of life has been reported to be significantly worse after VD than after CS in the short term, but the long-term effects remain unknown[16]. Foulon et al.[4] conducted a systematic review of the delivery mode used among women with inflammatory bowel disease. In this review, eight studies involving 358 patients reported that the mean frequencies of incontinence symptoms were 33% after VD and 54% after CS, although the difference was not significant. Another study of post-IPAA patients showed no differences in pouch dysfunction between the CS and VD groups[6-8,17]. Similarly, Ravid et al.[6] and Hahnloser et al.[7] reported that the mode of delivery should be dictated by obstetric or specific local perianal conditions because VD after IPAA is safe and is not associated with an increased incidence of pouch function disturbances. Thus, whether CS or VD is better for females after IPAA remains controversial[4,16,17], and patients often have difficulty selecting the mode of delivery.

However, systematic reviews or consensus statements have concluded that when there are concerns regarding damage to the pelvic floor and perianal obstetric injury, CS may be a suitable delivery method for pregnant women who have undergone IPAA[4,9,11,17]. The evidence level is too low to support their recommendation because previous cohort studies had a small number of patients, and adverse events during both CS and VD were not well evaluated.

Thus, we performed this study as a cohort study to increase the number of patients and to elucidate what the important clinical information would be to inform further recommendations made by colorectal surgeons. We found some problems during delivery, as stated below in this series. Although we could not evaluate other adverse events, including infectious complications, the incidence of episiotomy and its intractability, or long-term prognosis, we recognize that this clinical information will be needed for further analysis.

Generally, common indications for CS should be determined on the basis of the obstetric state[18,19]. It is necessary to recognize the high risk of injury after uterine surgery; nevertheless, a history of other abdominal surgeries is not always an indication for CS. Regarding the risks associated with each delivery mode, it has been reported that VD may damage the anal sphincter as the fetus passes through the vagina, even in individuals with gestations that are not complicated by other diseases or conditions[20-24]. CS is associated with a higher risk of maternal mortality or morbidity and neonatal respiratory disorder than VD[19,25]. Among patients who have undergone IPAA for UC, we

found that bowel obstructions could develop after CS, and fecal incontinence and an increased stool frequency could develop, even after CS, according to this analysis. In the VD group, we found one case of vaginal fistula after delivery, although the association between VD and fistulizing is unclear because injuries of the soft parturient canal can commonly develop during delivery[26,27]. The remaining three patients with VD had no problems after delivery. We should consider the risk of bowel obstruction and worsening pouch function even after CS. In VD, although 3/4 of the patients had no problems, we cannot provide any recommendations for VD, and studies with large populations are needed to determine whether it is safe and what its disadvantages are.

Although we could not obtain or confirm the role of episiotomy in this series, knowing about episiotomy is crucial for evaluating fistulization. In 2009, a meta-analysis reported that routine episiotomy for all VDs can be a greater risk for obstetric injury than restrictive episiotomy when necessary[28]. They stated that restrictive episiotomy had a low risk for severe obstetric injury (relative risk (RR), 0.67; 95% confidence interval (CI), 0.49-0.91) but a high risk for anterior obstetric injury (RR, 1.84; 95% CI, 1.61-2.10). However, additional knowledge regarding the clinical course of episiotomy is needed to elucidate the incidence and risk of fistulizing complications.

Interestingly, fecal incontinence and an increased stool frequency occurred even after CS. Although pelvic disorders, which include urinary incontinence, pelvic organ prolapse, or anal incontinence, occur less often in individuals who undergo CS than in those who undergo VD during typical gestations, it has been reported that anal incontinence can develop after CS[29]. Fetal development itself may affect by pelvic floor disorder with or without vaginal passage. Thus, we may not need to select CS to avoid poor pouch function.

Generally, postpartum fecal incontinence commonly develops regardless of previous surgery. Therefore, outcomes may be altered by the timing of the survey. However, an interval of over 2 years between delivery and the survey was confirmed for all patients except for two whose function was not poor immediately after delivery. We thought this survey could be performed at stable periods after delivery.

In our study, there was no significant difference in the rate of increased stool frequency or fecal incontinence per day after delivery. A total of five patients complained of increased stool frequency. Although the mechanism for increased stool frequency is unknown, patients with increased stool frequency after delivery might defecate to avoid soiling; hence, their stool frequency might increase. The only case of increased frequency after VD involved a patient who experienced three VDs before IPAA and vaginal fistula after the 4th VD post-IPAA. The number of previous deliveries may have affected this patient's defecation function[20,21].

The other three patients in the VD group did not show a decline in defecation function.

The limitations of this study are as follows. First, this study included a retrospective analysis of a small number of cases treated at a single center; the number of VD cases was extremely small and was not suitable for accurate statistical analysis. Second, most patients underwent CS after IPAA. Our previous chief chairperson, J Utsunomiya, who is one of the pioneers of pouch reconstruction, instructed us to avoid VD after IPAA because of its association with fecal incontinence[30]. Thus, surgeons in our institution tend to recommend CS. Third, the intervals between the date of delivery and the date of the questionnaire survey included various time periods. This limitation could affect the evaluation of pouch function according to differences in the intervals. Fourth, clinical information regarding episiotomy was missing. Moreover, we could not obtain morbidities other than bowel obstruction that occurred during delivery, including thrombosis, surgical site infection, and bleeding. Fifth, we cannot prove a clear association between CS and bowel obstruction, which might happen coincidentally. Lastly, this questionnaire survey that included information regarding bowel and pouch function according to the Wexner score or morbidities, including bowel obstruction after delivery over several decades, seems to be ambiguous and difficult to accurately analyze. We should conduct prospective studies with larger sample sizes in the future.

In conclusion, our study confirmed that there was no significant difference in postpartum pouch function between the CS and VD groups after IPAA. Alternatively, differences in postpartum complications were observed in both the CS and VD groups. However, we could not recommend delivery methods after IPAA on the basis of the results of this study. Additional analyses to elucidate the relationship between CS and postoperative complications or vaginal fistula and episiotomy in VD and long-term evaluations are required, and nationwide or worldwide multiinstitutional research should be conducted.

#### Conflicts of Interest

There are no conflicts of interest.

#### Author Contributions

Y Goto: conception and design of the study, acquisition, analysis and interpretation of the data, and drafting the article. T Minagawa, K Kusunoki, K Kimura, K Kataoka, R Kuwahara, Y Horio, N Beppu: conception and design of the study and acquisition, analysis and interpretation of the data. M Uchino, H Ikeuchi, M Ikeda: acquisition of the data, drafting the article or critical revision of the article for important intellectual content, and final approval.

Approval by Institutional Review Board (IRB)

All study protocols were approved by the institutional review board at the Hyogo College of Medicine (no. 3367).

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