

Pregnancy and Delivery Before and After Ileal Pouch-Anal Anastomosis for Inflammatory Bowel Disease: Immediate and Long-Term Consequences and Outcomes

Dieter Hahnloser, M.D.,^{1,2} John H. Pemberton, M.D.,¹ Bruce G. Wolff, M.D.,¹ Dirk Larson, M.S.,¹ Jeffrey Harrington, M.S.,¹ Ridzuan Farouk, M.D.,¹ Roger R. Dozois, M.D.¹

¹ Division of Colon and Rectal Surgery, Mayo Clinic, Rochester, Minnesota

² Division of Visceral and Transplant Surgery, University Hospital Zurich, Zurich, Switzerland

PURPOSE: This study was designed to evaluate pregnancy, delivery, and functional outcome in females before and after ileal pouch-anal anastomosis for chronic ulcerative colitis. **METHODS:** From a prospective database of 1,454 patients who underwent ileal pouch-anal anastomosis for chronic ulcerative colitis between 1981 and 1995, a standardized questionnaire was sent to all female patients aged 40 years or younger at the time of ileal pouch-anal anastomosis (n = 544). **RESULTS:** The response rate was 83 percent (450/544) with a mean follow-up after ileal pouch-anal anastomosis of 13 years. A total of 141 females were pregnant after the chronic ulcerative colitis diagnosis, but before ileal pouch-anal anastomosis (236 pregnancies; mean, 1.7) and 87 percent delivered vaginally. A mean of five (range, 1–16) years after ileal pouch-anal anastomosis, 135 females were pregnant (232 pregnancies; mean, 1.7). Comparison of pregnancy and delivery before and after ileal pouch-anal anastomosis in the same females (n = 37) showed no difference in birth weight, duration of labor, pregnancy/delivery complications, vaginal delivery rates (59 percent before *vs.* 54 percent after ileal pouch-anal anastomosis),

and unplanned cesarean section (19 *vs.* 14 percent). Planned cesareans occurred only after ileal pouch-anal anastomosis and were prompted by obstetrical concerns in only one of eight. Pouch function at first follow-up after delivery (mean, 7 months) was similar to pregravid function. After ileal pouch-anal anastomosis, daytime stool frequency was the same after delivery as pregravid (5.4 *vs.* 5.4, not significant) but was increased at the time of last follow-up (68 months after delivery; 5.4 *vs.* 6.4; $P < 0.001$). The rate of occasional fecal incontinence also was higher (20 percent after ileal pouch-anal anastomosis and 21 percent pregravid *vs.* 36 percent at last follow-up; $P = 0.01$). No difference in functional outcome was noted compared with females who were never pregnant after ileal pouch-anal anastomosis (n = 307). Age and becoming pregnant did not affect the probability of pouch-related complications, such as stricture, pouchitis, and obstruction. **CONCLUSIONS:** Successful pregnancy and vaginal delivery occur routinely in females with chronic ulcerative colitis before and after ileal pouch-anal anastomosis. The method of delivery should be dictated by obstetrical considerations. Pouch function and the incidence of complications in females with pregnancies seem largely unaffected long-term. [Key words: Ileal pouch-anal anastomosis; Pregnancy; Delivery; Pouch function; Chronic ulcerative colitis]

Read at the meeting of The American Society of Colon and Rectal Surgeons, New Orleans, Louisiana, June 23 to 27, 2003.

Correspondence to: John H. Pemberton, M.D., Division of Colon and Rectal Surgery, Mayo Clinic, 200 First Street SW, 55905, Rochester, Minnesota, e-mail: pemberton.john@mayo.edu

Dis Colon Rectum 2004; 47: 1127–1135

DOI: 10.1007/s10350-004-0569-0

© The American Society of Colon and Rectal Surgeons

Published online: 28 May 2004

Ileal pouch-anal anastomosis (IPAA) is the surgical treatment of choice for patients requiring proctocolectomy for chronic ulcerative colitis (CUC), because the goals of eliminating disease and preserving

fecal continence are achieved in the great majority of patients. Females requiring IPAA are usually young and, thus, are within the reproductive years. Previous reports from this institution and others have documented that patients after IPAA can carry their pregnancies to term with minimal alterations in pouch function.¹⁻⁶ However, the most controversial aspects of IPAA and pregnancy relate to the preferred route of delivery (vaginal or cesarean section) and the long-term effects of delivery on pouch function. Most studies have been limited by small numbers of patients and short follow-up. This study was designed to evaluate the effect of pregnancy and method of delivery on functional outcomes in females with CUC before and after IPAA.

METHODS

Among 1,454 patients who underwent IPAA for CUC between 1981 and 1995, a standardized questionnaire was sent to all female patients aged 40 years and younger at the time of IPAA ($n = 544$). All IPAA patients are registered in a prospectively managed database and followed by questionnaires. Importantly, no surgeon was involved in the follow-up process. Questions concerned pregnancy and delivery before and after IPAA and, more specifically, the outcome and complications of pregnancy and delivery. The method of delivery, length of labor, and birth weight of the baby also were noted. Details of pouch function were elicited as described previously.² Furthermore, for every patient, annual functional follow-up data from the time of IPAA was available from the prospective database and was used to compare prepregnancy to postpartum function.

All patients underwent abdominal colectomy, complete mobilization of the small-bowel mesentery, and proximal rectal mobilization using a close rectal dissection technique.^{7,8} The patients underwent IPAA either excising the anal transition zone (ATZ) and handsewing the pouch to the anal canal or by preserving the ATZ and double stapling the pouch to the anal canal. All patients had a diverting ileostomy constructed, which was closed between two to three months after IPAA. Details of both handsewn and double stapled IPAA are detailed in Reilly *et al.*⁹

Statistical Analysis

Summary statistics are reported as mean (\pm standard deviation) for continuous variables and count

(percentage) for discrete variables. For comparisons of paired data (*e.g.*, comparing pregnancy and delivery data of females pregnant both before and after IPAA), continuous variables were evaluated using paired *t*-tests or signed-rank tests; binomial outcomes were compared using McNemar's tests. When three or more outcomes on the same patients were evaluated, Friedman's tests were used to compare continuous variables and ordinal variables, and Cochran's Q tests were used to assess binomial end points. Comparisons of data subsets involving nonpaired data (*e.g.*, those pregnant *vs.* those never pregnant) were performed using two-sample *t*-tests or rank-sum tests for continuous variables; discrete variables were compared using chi-squared tests. The cumulative probability of each type of complications was estimated using the Kaplan-Meier method. To evaluate the effect of pregnancy after IPAA on the long-term complication rates, pregnancy was incorporated into Cox proportional hazards models adjusted for age. Predicted complication rates based on these models were estimated using a hypothetical, 30-year-old female as a reference. All statistical tests were two-sided, and the threshold of statistical significance was set at $\alpha = 0.05$. All analysis was conducted using SAS version 8.02 (SAS Institute, Inc., Cary, NC) and S-Plus version 6.1.2 (Insightful Corporation, Seattle, WA).

RESULTS

Among 544 females aged 40 years and younger who underwent IPAA for CUC between 1981 to 1995, 450 returned the questionnaire (83 percent response rate). Table 1 shows the number of patients and pregnancies in different time periods. A total of 135 females were pregnant after IPAA and 307 females were never pregnant after IPAA. For eight females, the time of pregnancy was not reported, and they were excluded from the analyses.

IPAA Surgery

Comparing females with pregnancies after IPAA ($n = 135$) to females never pregnant after IPAA ($n = 307$), no differences were seen in rates of previous abdominal operations (16 *vs.* 12 percent; $P = 0.3$), rates of emergency pouch surgery (1 percent for both groups; $P = 0.6$), and rates of handsewn anastomoses (4 *vs.* 7 percent; $P = 0.5$). Nearly all patients were diverted after IPAA (99 *vs.* 98 percent; $P = 0.7$) with time to ileostomy closure (mean, 2.7 *vs.* 3.2 months; $P = 0.2$)

Table 1.

Patient Distribution During Different Pregnancy Periods

Patient Distribution During Different Pregnancy Periods	
No. of Patients (N = 450)	
109	Never pregnant
90	Pregnant before CUC diagnosis only
55	Pregnant before CUC diagnosis, and between CUC and IPAA
15	Pregnant before CUC diagnosis and after IPAA
8	Pregnant before CUC, between CUC and IPAA, and after IPAA
47	Pregnant between CUC and IPAA only
29	Pregnant between CUC and IPAA, and after IPAA
83	Pregnant after IPAA only
14	Females missing one or more variables to identify pregnancy period (6 never pregnant after IPAA and unknown before IPAA, and 8 pregnant before and/or after CUC diagnosis)

CUC = chronic ulcerative colitis; IPAA = ileal pouch-anal anastomosis.

and type of closure (98 vs. 96 percent handsewn; $P = 0.4$) similar in both groups. Also, partial obstruction rates after ileostomy closure were comparable in the two groups (4 vs. 6 percent; $P = 0.5$). Not unexpectedly, females who were pregnant after IPAA were significantly younger at the time of surgery than females who were never pregnant after IPAA (25 vs. 30 years; $P < 0.001$). At the time of the questionnaire (average, 13 years after the IPAA), most females rated their general health as excellent (21 percent), very good (42 percent), or good (23 percent), and only few as fair (12 percent) or poor (1 percent). No difference between the two groups was noted.

Pregnancies After CUC Diagnosis but Before IPAA

A total of 141 females became pregnant after the diagnosis of CUC but before IPAA (236 pregnancies; mean, 1.7). The mean duration of labor was 6 ± 5 hours, and the average birth weight was 7.1 ± 1.8 pounds. One hundred two of 117 females (87 percent) gave birth vaginally (97 spontaneous and 5 by elective termination) with vaginal tears occurring in 29 females (28 percent) and forceps deliveries in 32 females (31 percent). Cesarean section was performed in 15 females (13 percent; 3 planned and 12 unplanned). The following pregnancy related complications occurred: preeclampsia (n = 16 females), ges-

Table 2.

Baby Data, Delivery Method, and Complications in 135 Patients With 232 Pregnancies After IPAA

Baby Data, Delivery Method, and Complications in 135 Patients With 232 Pregnancies After IPAA	
Mean birth weight (pounds)	7.3 ± 1.3
Mean duration of labor (hr)	7.1 ± 7
Delivery method	
Vaginal spontaneous	104 (45)
Vaginal elective termination	6 (2)
Because of IPAA	2
Not because of IPAA	3
Missing information	1
Planned cesarean	62 (27)
Because of IPAA	45
Not because of IPAA	15
Missing information	2
Unplanned cesarean	25 (11)
Because of IPAA	4
Not because of IPAA	18
Missing information	3
Missing information	35 (15)
	232 (100)
Vaginal delivery complications	
Vaginal tear	38/110 (35)
Forceps delivery	13/110 (12)
No complications	60/110 (55)
Pregnancy complications	
Gestational diabetes	5 (2)
Preeclampsia	10 (4)
Eclampsia	1 (0.4)
Miscarriage	31 (13)
Stillbirth	2 (1)
No complications	167 (72)
Missing information	16 (7)
	232 (100)

IPAA = ileal pouch-anal anastomosis.

Data are numbers with percentages in parentheses unless otherwise indicated.

tational diabetes (n = 14), eclampsia (n = 6), miscarriage (n = 27), stillbirth (n = 4). Ninety females experienced no complications (64 percent).

Pregnancies After IPAA

A total of 135 females became pregnant after IPAA (Table 2). They had 232 pregnancies (range, 1–6; mean, 1.7) at an average of 58 months (range, 13 months to 16 years) after IPAA. Twenty-two females had three or more pregnancies. Seventy-two percent of pregnancies were without complications. Planned cesareans were frequent (27 percent of pregnancies) and, in two-thirds, were related to the presence of an IPAA. Vaginal deliveries were reported in 47 percent of pregnancies. Mean birth weight and mean duration of labor were similar to babies born before the IPAA. Not unexpectedly, females with unplanned cesarean sections after IPAA had a longer duration of labor

Table 3.
Baby Data, Delivery Method, and Complications in 37 Patients Pregnant Before and After IPAA

	Pregnancy Before IPAA	First Pregnancy After IPAA	<i>P</i> Value
Mean birth weight (pounds)	6.8 ± 1.4	7.2 ± 1.2	0.1
Mean duration of labor (hr)	6.5	6	NA ^a
Delivery method			
Vaginal spontaneous	22 (59)	20 (54)	0.62
Vaginal elective termination	3 (8)	0	NA
Planned cesarean	0	8 (22)	NA
Because of IPAA	—	7	
Not because of IPAA	—	1	
Unplanned cesarean	7 (19)	5 (13)	0.56
Because of IPAA	—	2	
Not because of IPAA	—	2	
Missing information	—	1	
Delivery method missing	5 (14)	4 (11)	NA
Vaginal delivery complications			
Vaginal tear	8/22 (36)	5/20 (25)	NA
Forceps delivery	7/22 (32)	2/20 (10)	NA
No complication	10/22 (45)	9/20 (45)	NA
Vaginal delivery complications of 13 females with vaginal delivery before and after IPAA			
Vaginal tear	6 (46)	3 (23)	0.08
Forceps delivery	4 (31)	1 (8)	0.08
Pregnancy complications			
Gestational diabetes	3	0	NA
Preeclampsia	5	0	NA
Eclampsia	2	0	NA
Miscarriage	10	6	0.25
Stillbirth	2	2	1
	27 (73)	29 (78)	0.56

IPAA = ileal pouch-anal anastomosis; NA = not available.

Data are numbers with percentages in parentheses unless otherwise indicated.

^an = 1.

compared with females with vaginal deliveries (16.9 *vs.* 6.1 hours), but the difference was not significant (*P* = 0.07).

Pregnancies Before and After IPAA in the Same Females

A total of 52 females were pregnant before and after IPAA. For 37 of them, pregnancy and delivery data was available for both time periods (Table 3). No difference in birth weight, duration of labor, and pregnancy/delivery complications were noted. For the first post-IPAA delivery, vaginal delivery rates and unplanned cesareans also were comparable. Planned cesareans only occurred after IPAA, and only in one of eight was prompted by obstetrical concerns. Five of those eight females gave birth vaginally before the IPAA. Including multiple pregnancies after IPAA, in 9 of 12 females (75 percent), the planned cesarean was because of the IPAA. A total of 13 females gave birth vaginally before and after the IPAA. One female, after

an unplanned cesarean before the IPAA, gave birth vaginally to another three children after the IPAA.

Pouch Function

For 135 females pregnant after IPAA, functional outcome at the last follow-up before pregnancy (average, 58 months after the IPAA), the first follow-up after delivery (mean, 7 months), and at the last available follow-up (68 months after the last delivery; Table 4) were compared. Average daytime stool frequency were similar before pregnancy and immediately postpartum, but increased with longer follow-up (*P* < 0.001). Nocturnal stool frequencies did not change (*P* = 0.19). Daytime and nighttime incontinence rates increased with time (*P* = 0.01 and *P* = 0.06, respectively), but frequent incontinence remained low. Similarly, pad usage and use of stool regulating medications also increased with time, but did not change when comparing prepregnancy and immediate postpartum status. When comparing fe-

Table 4.
Functional Outcome Before and After Pregnancy and at Last Follow-Up of 135 Females With Pregnancies After IPAA Surgery

	Last F/U Before Pregnancy	First F/U After Pregnancy	Last F/U	<i>P</i> Value
Month after IPAA surgery	58 (±36)	66 (±44)	158 (±69)	—
No. of stools per day	5.4 (±2)	5.4 (±2)	6.4 (±2.6)	<0.001
No. of stools per night	1.1 (±1)	1.2 (±0.9)	1.3 (±1)	0.19
Incontinence (day)				
None	79	77	64	0.01
Occasional	20	21	36	
Frequent	1	2	0	
Incontinence (night)				
None	59	52	37	0.06
Occasional	33	39	63	
Frequent	8	9	0	
Pad usage				
No (spots only)	84	82	75	0.07
Wears pad	16	18	25	
Can tell stool from gas				
No	17	19	30	<0.01
Yes	83	81	70	
Use of stool-regulating medication				
No	71	67	74	0.09
Yes	29	33	26	

IPAA = ileal pouch-anal anastomosis; F/U = follow-up. Data are percentages unless otherwise indicated.

males who had vaginal deliveries with those who only had cesarean sections, there was no significant difference in daytime or nighttime stool frequency or incontinence rates (Table 5). Also, no difference in pouch function was seen in females with vaginal delivery complication with the exception of an increased occasional nighttime incontinence (54 *vs.* 33 percent; *P* = 0.04) and a trend of higher pad (41 *vs.* 19 percent; *P* = 0.05; Table 6).

Comparing functional outcome in the 135 females pregnant after IPAA to the 307 females never pregnant after IPAA, showed no significant differences, with the exception of more frequent use of stool regulating medications in the first group (*P* = 0.01; Table 7).

With time, age and becoming pregnant did not affect the probability of pouchitis and stricture (Fig. 1A and B). The probability of obstruction was higher in pregnant females and highest if the time of pregnancy was close to the date of IPAA (Fig. 1C). The probability of other pouch complications (abscess and fistula formation) did not change (data not shown).

DISCUSSION

Chronic ulcerative colitis has a peak of onset between 15 and 30 years of age. Hence, many females with CUC who have the desire to have children may

have their pregnancies impacted by the disease and its medical and surgical management. Fecundability (the biologic ability to conceive) can be normal in CUC patients,¹⁰⁻¹² and pregnancy and delivery are possible if the disease is inactive.^{13,14} Indeed, we found that in 141 females who had 236 pregnancies after their CUC diagnosis but before IPAA, pregnancy-related complications, delivery methods, duration of labor, and birth weight were similar to what is expected in an unoperated control group of pregnant females.¹⁵

Disturbingly, after IPAA, pregnancy is five times less likely to occur than in the comparable general population.^{11,16} The reason for the significant decrease in fertility post-IPAA is unknown, but one contributing factor may be pelvic adhesions. After pelvic surgery, the ovaries and fallopian tubes are frequently found to be involved in dense pelvic adhesions or are distorted and obstructed by scar tissue.¹² Such adhesions may be reduced with instillation of adhesion-prevention gels into the abdominal cavity^{17,18} or by a laparoscopic approach.¹⁹ Whether laparoscopy reduces formation of adhesions in the pelvis and, therefore, could influence fertility in CUC patients is the subject of ongoing studies. Another method to preserve fertility is oophoropexy (suturing the ovary to the pelvic sidewall).²⁰ Antiadhesion barriers, oopho-

Table 5.
Pouch Function by Delivery Method of 135 Females Pregnant After IPAA

	At Least One Vaginal Delivery	Cesarean Sections Only	<i>P</i> Value
No. of females	71	54	
Mean follow-up after last delivery (mo)	84.1 (\pm 54.5)	69.3 (\pm 51.8)	0.11
Mean birth weight (pounds)	7.3 (\pm 1.3)	7.4 (\pm 1.2)	0.94
Mean duration of labor (hr)	6.1 (\pm 5.5)	16.9 (\pm 12.4)	0.07
Mean number of stools per day	5.3 (\pm 2)	5.3 (\pm 1.9)	0.9
Mean number of stools per night	1.1 (\pm 1)	0.9 (\pm 0.9)	0.07
Incontinence (day)			
None	76	85	0.3
Occasional	20	13	
Frequent	4	2	
Incontinence (night)			
None	47	62	0.1
Occasional	44	32	
Frequent	9	6	
Pad usage			
No (spots only)	70	82	0.13
Wears pad	30	18	
Can tell stool from gas			
No	23	20	0.75
Yes	77	80	
Use of stool-regulating medication			
No	64	61	0.76
Yes	36	39	

IPAA = ileal pouch-anal anastomosis.

Data are percentages unless otherwise indicated.

Table 6.
Pouch Function by Vaginal Delivery Complication in 71 Females Pregnant After IPAA With One or More Vaginal Deliveries

	Vaginal Deliveries		<i>P</i> Value
	No Complication	With Vaginal Tears and/or Forceps Delivery	
No. of females	33	38	
Mean follow-up after last delivery (mo)	89.4 (\pm 54.3)	79.7 (\pm 54.9)	0.47
Mean birth weight (pounds)	7.3 (\pm 1.3)	7.3 (\pm 1.3)	0.93
Mean duration of labor (hr)	4.6 (\pm 3.7)	7.7 (\pm 6.6)	0.16
Number of stools per day	5.6 (\pm 2.3)	5.1 (\pm 1.8)	0.32
Number of stools per night	1.1 (\pm 1)	1.2 (\pm 0.9)	0.56
Incontinence (day)			
None	79	75	0.6
Occasional	21	17	
Frequent	0	8	
Incontinence (night)			
None	61	35	0.04
Occasional	33	54	
Frequent	6	11	
Pad usage			
No (spots only)	81	59	0.05
Wears pad	19	41	
Can tell stool from gas			
No	21	25	0.71
Yes	79	75	
Use of stool-regulating medication			
No	64	64	0.98
Yes	36	36	

IPAA = ileal pouch-anal anastomosis.

Data are percentages unless otherwise indicated.

Table 7.
Functional Outcome Comparing Females With Pregnancies After IPAA to Females Never Pregnant After IPAA.

	Pregnant After IPAA	Never Pregnant After IPAA	<i>P</i> Value
No. of females	135	307	
Mean age (yr)	25.8 (±5)	30.4 (±6.3)	<0.001
Mean follow-up (mo)	158 (±69)	153 (±67)	0.5
Number of stools per day	6.4 (±2.6)	6.7 (±3.1)	0.55
Number of stools per night	1.3 (±1)	1.7 (±1.7)	0.11
Incontinence (day)			
None	64	60	0.44
Occasional	36	40	
Frequent	0	0	
Incontinence (night)			
None	37	40	0.52
Occasional	63	60	
Frequent	0	0	
Pad usage			
No (spots only)	75	69	0.21
Wears pad	25	31	
Can tell stool from gas			
No	33	29	0.73
Yes	70	71	
Use of stool-regulating medication			
No	74	61	0.01
Yes	26	39	

IPAA = ileal pouch-anal anastomosis.

Data are percentages unless otherwise indicated.

ropey, or laparoscopy were not routinely used in this study population, and fertility was not examined specifically. Nevertheless, after IPAA, 135 of 450 females became pregnant a total of 232 times.

We found that most of the 135 females had uncomplicated pregnancies (72 percent) and were able to carry until term. Pregnancy-related complications did not occur more frequently than expected in IPAA patients. Although we did not evaluate pouch-related complications during pregnancy in this study, previous reports have described a much lower complication rate in IPAA patients (3–7 percent)^{1,2,4} than that reported in females with ileostomies (29 percent)²¹ or Koch pouches (53 percent).²² Small-bowel obstruction seems to be a rare occurrence in pregnant IPAA patients. Two cases of obstruction resolved with delivery^{1,23} and two with nonsurgical management.² After delivery, the rate of pouch-related complications in IPAA patients was not increased. Age and becoming pregnant did not influence the occurrence of pouch-related complications, such as pouchitis, obstruction, or stricture. Therefore, it seems clear that major pouch-related complications during pregnancy are unusual and that after delivery, the incidence does not seem to increase.

Previous reports have shown a significant increase

in stool frequency, incontinence, and pad usage during pregnancy, but prepregnancy function was promptly restored after delivery.^{2–4} With a mean follow-up of nearly six years after the last pregnancy in this study, this earlier observation is confirmed; we could find no significant differences in stool frequency or sensation among females who were pregnant after IPAA and those never pregnant after IPAA. The increase of daytime stools (from 5 to 6) and the decrease of the ability to distinguish between stool and gas (from 83 to 70 percent) before pregnancy compared with the last follow-up is more likely an effect of time rather than caused by the pregnancy itself. Similar changes in pouch function with time are seen in other studies including male patients. Moreover, male patients experience the same changes.^{24–26} Thus, it seems that pregnancy results in transient and inconvenient but nondebilitating alterations in pouch function that resolve after delivery.

There is no consensus regarding the preferred method of delivery in females after IPAA. The first case report of a successful pregnancy and delivery after IPAA in 1984²⁷ recommended cesarean section for protection of the anal sphincter. Elective cesarean delivery does not decrease pelvic muscle strength; maximum anal resting and squeeze pressures are un-

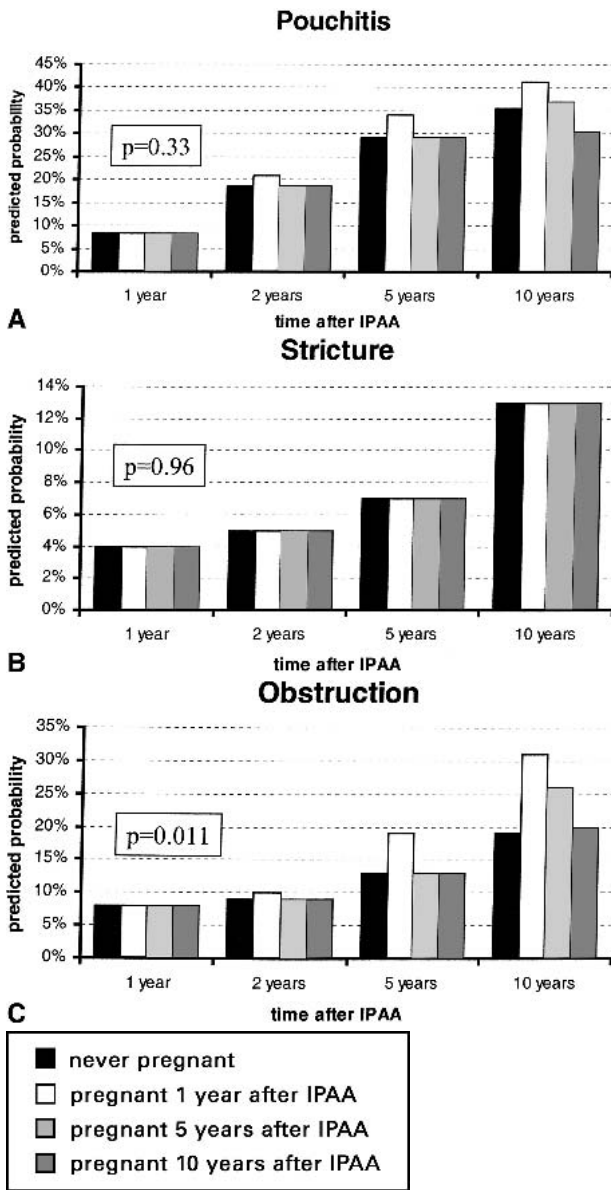


Figure 1. Predicted probability of pouch-related complications in 30-year-old females never pregnant after IPAA compared with 30-year-old females pregnant 1, 5, or 10 years after IPAA.

changed, as is anal sphincter morphology, whereas cesarean section during labor may not prevent anal incontinence.^{28,29} However, every cesarean delivery is associated with all the complications of abdominal surgery, including formation of adhesions, and after delivery recovery is prolonged. On the other hand, vaginal delivery may increase the risk of pudendal nerve damage, anal sphincter injury, thus increasing the chances of fecal continence in these patients.

In our study, 56 percent of females after IPAA gave birth vaginally, 44 percent by cesarean section, com-

pared with an overall 24 percent cesarean section rate in the United States in 2001.¹⁵ However, vaginal delivery rates before and after IPAA in 37 females were not significantly different and planned cesarean sections only occurred after IPAA. Thirteen of 37 females gave birth vaginally before and after IPAA with similar vaginal delivery complication rates. Furthermore, vaginal delivery itself or its complications did not have any significant influence on long-term pouch function compared with females with only cesarean section. The failure to show any difference may be related to a certain selection bias, and it is important to recognize that some patients may be best suited for cesarean section because of perineal inadequacy. Also, occult sphincter injuries after vaginal delivery occur in up to 35 percent of females and may not become clinically significant for many years.^{28,30,31} With aging, these patients may become symptomatic and pouch function could be affected negatively. All females pregnant after IPAA in this study were young and information on pouch function 30 years, 40 years, or more after delivery is not yet available. Only with such long-term follow-up will the full impact of the delivery method on pouch function be understood. Nevertheless, vaginal childbirth is safe even after IPAA and does not seem to affect pouch function adversely. Therefore, we continue to recommend vaginal delivery unless there are obstetric contraindications or unless the perineum is severely scarred or rigid and therefore unsuitable.

CONCLUSIONS

Successful pregnancy and vaginal delivery occur routinely in females with CUC before and after IPAA. Vaginal delivery is safe, not associated with increased complications, and does not seem to influence pouch function adversely. The method of delivery should be dictated by obstetrical considerations. Overall pouch function and the incidence of complications in females with pregnancies seemed unaffected during the time period studied. Because the life expectancy of these young females is long, functional outcomes of the study might be considered short-term, and these patients need to be followed closely as they get older.

REFERENCES

1. Counihan TC, Roberts PL, Schoetz DJ, Collier JA, Murray JJ, Veidenheimer MC. Fertility and sexual and gynecologic function after ileal pouch-anal anastomosis. *Dis Colon Rectum* 1994;37:1126-9.

2. Juhasz ES, Fozard B, Dozois RR, Ilstrup DM, Nelson H. Ileal pouch-anal anastomosis function following childbirth: an extended evaluation. *Dis Colon Rectum* 1995; 38:159-65.
3. Nelson H, Dozois RR, Kelly KA, Malkasian GD, Wolff BG, Ilstrup DM. The effect of pregnancy and delivery on the ileal pouch-anal anastomosis functions. *Dis Colon Rectum* 1989;32:384-8.
4. Ravid A, Richard CS, Spencer LM, *et al.* Pregnancy, delivery, and pouch function after ileal pouch-anal anastomosis for ulcerative colitis. *Dis Colon Rectum* 2002; 45:1283-8.
5. Scott HJ, McLeod RS, Blair J, O'Connor B, Cohen Z. Ileal pouch-anal anastomosis: pregnancy, delivery and pouch function. *Int J Colorectal Dis* 1996;11:84-7.
6. Zeldis JB. Pregnancy and inflammatory bowel disease. *West J Med* 1989;151:168-71.
7. Pemberton JH, Kelly KA, Beart RW, Dozois RR, Wolff BG, Ilstrup DM. Ileal pouch-anal anastomosis for chronic ulcerative colitis. Long-term results. *Ann Surg* 1987;206:504-13.
8. Kelly KA, Pemberton JH, Wolff BG, Dozois RR. Ileal pouch-anal anastomosis. *Curr Probl Surg* 1992;29:57-131.
9. Reilly WT, Pemberton JH, Wolff BG, *et al.* Randomized prospective trial comparing ileal pouch-anal anastomosis performed by excising the anal mucosa to ileal pouch-anal anastomosis performed by preserving the anal mucosa. *Ann Surg* 1997;225:666-77.
10. Hudson M, Flett G, Sinclair TS, Brunt PW, Templeton A, Mowat NA. Fertility and pregnancy in inflammatory bowel disease. *Int J Gynaecol Obstet* 1997;58:229-37.
11. Ording Olsen K, Juul S, Berndtsson I, Oresland T, Laurberg S. Ulcerative colitis: female fecundity before diagnosis, during disease, and after surgery compared with a population sample. *Gastroenterology* 2002;122: 15-9.
12. Oresland T, Palmblad S, Ellstrom M, Berndtsson I, Crona N, Hulten L. Gynaecological and sexual function related to anatomical changes in the female pelvis after restorative proctocolectomy. *Int J Colorectal Dis* 1994; 9:77-81.
13. Sorokin JJ, Levine SM. Pregnancy and inflammatory bowel disease: a review of the literature. *Obstet Gynecol* 1983;62:247-52.
14. Jamerot G. Fertility, sterility, and pregnancy in chronic inflammatory bowel disease. *Scand J Gastroenterol* 1982;17:1-4.
15. Martin JA, Hamilton BE, Ventura SJ, Menacker F, Park MM, Sutton PD. Births: final data for 2001. *Natl Vital Stat Rep* 2002;51:1-102.
16. Olsen KO, Joelsson M, Laurberg S, Oresland T. Fertility after ileal pouch-anal anastomosis in women with ulcerative colitis. *Br J Surg* 1999;86:493-5.
17. Thornton MH, Johns DB, Campeau JD, Hoehler F, Di-Zerega GS. Clinical evaluation of 0.5 percent ferric hyaluronate adhesion prevention gel for the reduction of adhesions following peritoneal cavity surgery: open-label pilot study. *Hum Reprod* 1998;13:1480-5.
18. Oncel M, Remzi FH, Senagore AJ, Connor JT, Fazio VW. Comparison of a novel liquid (Adcon-P) and a sodium hyaluronate and carboxymethylcellulose membrane (Seprafilm) in postsurgical adhesion formation in a murine model. *Dis Colon Rectum* 2003;46:187-91.
19. Hahnloser D, Young-Fadok TM. Earlier postoperative spontaneous diuresis in laparoscopic versus open total proctocolectomy and ileal pouch-anal anastomosis (IPAA). *Surg Endosc* 2003;17(Suppl):S238.
20. Matthews JM, Kodner IJ, Fry RD, Fazio VW. Entrapped ovary syndrome. *Dis Colon Rectum* 1986;29:341-3.
21. Gopal KA, Amshel AL, Shonberg IL, Levinson BA, VanWert M, VanWert J. Ostomy and pregnancy. *Dis Colon Rectum* 1985;28:912-6.
22. Ojerskog B, Kock NG, Philipson BM, Philipson M. Pregnancy and delivery in patients with a continent ileostomy. *Surg Gynecol Obstet* 1988;167:61-4.
23. Walker M, Sylvain J, Stern H. Bowel obstruction in a pregnant patient with ileal pouch-anal anastomosis. *Can J Surg* 1997;40:471-3.
24. Delaney CP, Remzi FH, Gramlich T, Dadvand B, Fazio VW. Equivalent function, quality of life and pouch survival rates after ileal pouch-anal anastomosis for indeterminate and ulcerative colitis. *Ann Surg* 2002;236: 43-8.
25. Farouk R, Pemberton JH, Wolff BG, Dozois RR, Browning S, Larson D. Functional outcomes after ileal pouch-anal anastomosis for chronic ulcerative colitis. *Ann Surg* 2000;231:919-26.
26. MacLean AR, Cohen Z, MacRae HM, *et al.* Risk of small bowel obstruction after the ileal pouch-anal anastomosis. *Ann Surg* 2002;235:200-6.
27. Pezim ME. Successful childbirth after restorative proctocolectomy with pelvic ileal reservoir. *Br J Surg* 1984; 71:292.
28. Peschers UM, Schaer GN, DeLancey JO, Schuessler B. Levator ani function before and after childbirth. *Br J Obstet Gynaecol* 1997;104:1004-8.
29. Sultan AH, Kamm MA, Hudson CN, Bartram CI. Effect of pregnancy on anal sphincter morphology and function. *Int J Colorectal Dis* 1993;8:206-9.
30. Donnelly V, Fynes M, Campbell D, Johnson H, O'Connell PR, O'Herlihy C. Obstetric events leading to anal sphincter damage. *Obstet Gynecol* 1998;92:955-61.
31. Sultan AH, Kamm MA, Hudson CN, Thomas JM, Bartram CI. Anal-sphincter disruption during vaginal delivery. *N Engl J Med* 1993;329:1905-11.