



## Original Article

## Peripartum anesthetic management of patients with inflammatory bowel disease, a retrospective case-control study

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## ABSTRACT

**Objective:** Inflammatory bowel diseases (IBD) are a group of pathologies associated with an increased rate of abortions, premature deliveries, cesarean sections and other morbidity during the peripartum period. The objective of this retrospective study was to investigate the anesthetic management for delivery of women with IBD.

**Material and methods:** The records of patients with IBD, who delivered at our Center, were obtained for data which included anesthetic and obstetric management as well as neonatal outcome. Five subgroups were defined based on mode of delivery, presence or absence of epidural in normal vaginal delivery (NVD) and urgency of cesarean section, each of which was compared with control groups of healthy parturients in the same period. Additionally, the rate of cesarean sections and the use of epidural analgesia for NVD were compared with the general obstetric population of our center in the same period. **Results:** 107 patients with IBD who delivered at our center were studied. The rates of cesarean sections and emergency cesarean sections were significantly higher compared to the general population. However, the rate of instrumental delivery and of epidural analgesia use for NVD were similar. Among those who underwent cesarean sections, no significant differences were found in anesthesia type, surgery duration, number of complications, type of monitoring or postoperative management compared to the control group.

**Conclusion:** Peripartum anesthetic management of patients with IBD does not differ significantly from that of parturients without it. Anesthesiologists can plan their anesthesia in a similar way as they do in healthy parturients.

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## Introduction

Inflammatory bowel diseases are a group of immune-mediated chronic intestinal conditions characterized by periods of activity and remission of variable duration. A pathological inflammation is present in the intestinal wall, which causes the main symptomatology of the patients who usually complain of diarrhea, abdominal pain and fever. Extraintestinal manifestations may be present with common musculoskeletal, skin, and ocular involvement [1].

The two main diseases of this group are Crohn's Disease and Ulcerative Colitis. The treatment includes immunosuppressive drugs, which on their own, may cause systemic adverse effects that may complicate the course of the disease. In severe cases, the treatment is surgical bowel resection. It is not uncommon for such patients to undergo multiple procedures, further complicating subsequent surgeries due to increasing adhesions [2].

Crohn's disease can cause perianal compromise with development of perianal fistulas and abscesses, which may complicate or even contraindicate vaginal delivery [3].

The incidence of the disease in the general population is rising and commonly affects women of childbearing age. Some studies suggest that IBD may contribute to infertility issues, as well as pregnancy, delivery and breastfeeding complications [4]. Other

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**Table 1**

IBD group summary.

				Total
Age (mean)		28.16		
Type of IBD	CD	71	66.4%	107
	UC	36	33.6%	
Disease location UC	Proctitis	6	16.7%	36
	LT colitis	16	44.4%	
	Extensive colitis	12	33.3%	
	Unknown	2	5.6%	
Disease location CD	Ileal	47	66.2%	71
	Colonic	6	8.5%	
	Ileocolonic	17	23.9%	
	Upper	1	1.4%	
	Unknown	0	0.0%	
Disease behaviour CD	Non-stricturing, non-penetrating	41	57.7%	71
	Stricturing	14	19.7%	
	Penetrating	14	19.7%	
	Stricturing and penetrating	2	2.8%	
Perianal disease (CD)		19	26.8%	71
Use of steroids		22	20.6%	107
Previous abdominal surgeries related to IBD	0	87	81.3%	107
	1	12	11.2%	
	2	4	3.7%	
	3	4	3.7%	
Previous abdominal surgeries not related to IBD	0	98	91.6%	107
	1	8	7.5%	
	2 or more	1	0.9%	
Disease activity at conception	Remission	82	76.6%	107
	Active disease	24	22.4%	
	Unknown	1	0.9%	
Flare during pregnancy	No	46	43.0%	107
	Yes	35	32.7%	
	Flare at conception	24	22.4%	
	Unknown	2	1.9%	
Comorbidities	No	88	82.2%	107
	HTN	1	0.9%	
	GDM	2	1.9%	
	Hypothyroidism	3	2.8%	

IBD: Inflammatory bowel disease, CD: Crohn's disease, UC: Ulcerative Colitis, HTN: Hypertension, GDM: gestational diabetes mellitus.

studies suggest that pregnancy may exacerbate symptomatic episodes of IBD [5].

According to several studies, pregnant women with inflammatory bowel disease show an increased incidence of peripartum complications including perinatal hemorrhage, emergent cesarean section and blood transfusion [6–14]. The increased morbidity and the more common complications of this population on delivery, the use of immunosuppressive therapy, the multisystem involvement of the disease and the increased rate of previous abdominal surgeries and perianal disease are all factors that may impact on the choice of anesthetic technique, the level of monitoring, the need of conversion to general anesthesia, the incidence of adverse intra-operative events and the decision regarding place for postoperative recovery. After review of the literature, no studies were found to refer to the peripartum anesthetic management of patients with IBD. The intention of this research was to conduct a retrospective study comparing the peripartum anesthetic management of patients with IBD to a healthy control group.

## Material and Methods

Our hospital is a single, general referral center with over 22,000 deliveries per year. The IBD MOM clinic is a joint unit of the Digestive Diseases Institute and the Maternal–Fetal Medicine Division of the Obstetrics and Gynecology Department. The team in the IBD MOM clinic includes a gastroenterologist, a maternal–fetal medicine specialist, an IBD nurse coordinator, a dietitian and a psychologist. The clinic provides a comprehensive consultation for

the preconception period, conception planning, medication safety, and management throughout pregnancy and postpartum period.

The study was conducted by gathering data of the patients from the database of our IBD MOM clinic and from medical records of the hospital between 2011 and 2018, which included general data: age, medical history, previous abdominal surgeries; obstetric data: gravity, parity, week of delivery, mode of delivery, complications after delivery, reason for cesarean section (CS), surgical complications, grade of adhesions, length of surgery, length of stay in hospital; anesthetic data: type of analgesia for normal vaginal delivery (NVD), type of anesthesia for CS, monitoring during surgery, estimated blood loss, need for transfusion, anesthetic complications, need for overnight stay in recovery room or transfer to ICU; gastroenterological data: type of IBD,

**Table 2**

Comparison of IBD group to general obstetric population in the same period in SZMC.

	IBD	General obstetric population	P
Epidural rate for NVD	58.14%	57.40%	0.89
Instrumental delivery rate	5.61%	5.30%	0.488
CS rate	19.63%	12.20%	*0.019
Elective CS	23.81%	61.00%	*<0.001
Urgent CS	76.19%	39.00%	
Mean maternal age	28	29 ± 5.8	0.111
Parity (Median)	1	3 [2–5]	*<0.001

SZMC: Shaare Zedek Medical Center, NVD: Normal vaginal delivery, CS: cesarean section.

\* Significance =  $P \leq 0.05$ .

**Table 3**  
Comparison of IBD to controls (NVD).

	NVD WITHOUT EPIDURAL				P	NVD WITH EPIDURAL				p
	IBD (36)		CONTROL (72)			IBD (50)		CONTROL (100)		
	n/mean	%	n/mean	%		n/mean	%	n/mean	%	
Gravity	3.39		3.35			2.64		2.76		
Parity	1.94		1.97			1.32		1.32		
Abortions in the past										
0	22	61.1%	56	77.8%	*0.006	38	76.0%	75	75.0%	0.727
1	13	36.1%	8	11.1%		9	18.0%	15	15.0%	
2 or more	1	2.8%	8	11.1%		3	6.0%	10	10.0%	
Week of delivery	39.14		39.57			39.42		39.43		
Number of newborns										
1	36	100.0%	72	100.0%		49	98.0%	98	98.0%	1.000
2	0	0.0%	0	0.0%		1	2.0%	2	2.0%	
Induction of labor	5	13.9%	0	0.0%	*0.003	12	24.0%	17	17.0%	0.306
Fever after delivery	1	2.8%	0	0.0%	0.333	2	4.0%	1	1.0%	0.258
LOS mother	2.72		2.44		0.091	2.74		2.82		0.631
Length of labor (min)	264.94		355.61		0.052	584.12		574.22		0.846
Instrumental delivery	1	2.8%	3	4.2%	1.000	5	10.0%	14	14.0%	0.487
Episiotomy	6	16.7%	7	9.7%	0.352	26	52.0%	26	26.0%	*0.002
Complications										
None	25	69.4%	41	56.9%	*0.023	35	70.0%	60	60.0%	0.840
Tear grade 1-2	7	19.4%	29	40.3%		10	20.0%	27	27.0%	
PPH & Tear grade 1-2	1	2.8%	2	2.8%		1	2.0%	3	3.0%	
PPH	2	5.6%	0	0.0%		2	4.0%	4	4.0%	
Others	1	2.8%	0	0.0%		2	4.0%	6	6.0%	
Weight of newborn	3149.86		3281.00		0.093	3284.16		3327.03		0.584
APGAR 1										
Apgar ≤ 7	1	2.8%	0	0.0%	0.333	1	2.0%	5	5.0%	0.664
Apgar>7	35	97.2%	72	100.0%		49	98.0%	95	95.0%	
APGAR 5										
Apgar ≤ 7	0	0.0%	0	0.0%		0	0.0%	2	2.0%	0.553
Apgar>7	36	100.0%	72	100.0%		50	100.0%	98	98.0%	
LOS newborn	2.83		2.42		*0.005	2.92		2.74		0.497
Complications newborn	4	11.1%	7	9.7%	1	9	18.0%	22	22.0%	0.568

LOS: length of stay, PPH: Postpartum hemorrhage.

\* Significance =  $P \leq 0.05$ .

perianal disease, immunosuppressive therapy, previous abdominal surgeries related to the disease, activity of the disease during pregnancy and neonatal data: weight, APGAR, length of stay in hospital and neonatal complications.

Patients were classified according to mode of delivery, presence or absence of epidural analgesia for NVD, and urgency of CS into 5 subgroups: NVD without epidural, NVD with epidural, Elective CS, Urgent CS, and All CS.

In order to match control groups for each of these 5 subgroups, parturients of the same age ( $\pm 1$  year) and parity, which gave birth in the same period (2011–2018) in our hospital, were selected. The selection was made using the delivery room's computer system. The control groups were set to be twice as large as each one of the research subgroups. For the statistical analysis the SPSS software was used to process the data. Comparison between IBD patients and controls was done using Student's *t*-test or Mann Whitney U test for interval data and Chi square or Fisher test for categorical data on each subgroup of patients.

In addition, the frequency of instrumental delivery, CS, urgent CS and epidural analgesia for NVD in the IBD group were compared to the general obstetric population that had delivery in the SZMC in the same period and statistical analysis with one sample chi square test was done.

## Results

The records of the 107 patients with IBD who gave birth in our center were analyzed. Of these, 86 (80.3%) women had NVD [50 (58.1%) with epidural and 36 (41.8%) without epidural] and 21

**Table 4**  
IBD group, comparison with and without epidural analgesia.

	IBD				P
	WITHOUT EPI		WITH EPI		
	n/mean	%	n/mean	%	
Gravity	3.39		2.64		
Parity	1.94		1.32		
Week of delivery	39.14		39.42		
Induction of labor	5	13.9%	12	24.0%	0.245
Fever after delivery	1	2.8%	2	4.0%	1
LOS mother	2.72		2.74		0.919
Length of labor (min)	264.94		584.12		*<0.001
Instrumental delivery	1	2.8%	5	10.0%	0.394
Episiotomy	6	16.7%	26	52.0%	*0.01
Complications					
None	25	69.4%	35	70.0%	1
Tear grade 1-2	7	19.4%	10	20.0%	
PPH & Tear grade 1-2	1	2.8%	1	2.0%	
PPH	2	5.6%	2	4.0%	
others	1	2.8%	2	4.0%	
Weight of newborn	3149.86		3284.16		0.167
APGAR 1					
Apgar ≤ 7	1	2.8%	1	2.0%	1
Apgar>7	35	97.2%	49	98.0%	
APGAR 5					
Apgar ≤ 7	0		0		1
Apgar>7	36		50		
LOS newborn	2.83		2.92		0.812
Complications newborn	4	11.1%	9	18.0%	0.379

LOS: length of stay, PPH: Post partum hemorrhage.

\* Significance =  $P \leq 0.05$ .

**Table 5**  
Comparison of IBD to controls CS.

	Elective CS						Urgent CS						Total CS					
	IBD (5)			CONTROL (10)			IBD (16)			CONTROL (32)			IBD (21)			CONTROL (42)		
	n/mean	%		n/mean	%	P	n/mean	%		n/mean	%		n/mean	%		n/mean	%	P
Gravity	4.80			5.10			1.94			2.25			2.62			2.93		
Parity	3.40			3.40			0.75			0.75			1.38			1.38		
Abortions in the past																		
0	3	60.0%		5	50.0%	1.00	15	93.8%		22	68.8%	0.095	18	85.7%		27	64.3%	0.279
1	2	40.0%		3	30.0%		0			7	21.9%		2	9.5%		10	23.8%	
2 or more	0			2	20.0%		1	6.3%		3	9.4%		1	4.8%		5	11.9%	
Week of delivery	38.20			38.50		0.594	37.19			38.31		0.200	37.43			38.36		0.263
Number of newborns																		
1	5	100.0%		9	90.0%	1.00	15	93.8%		32	100.0%	0.333	20	95.2%		41	97.6%	1
2	0			1	10.0%		1	6.3%		0			1	4.8%		1	2.4%	
Fever after delivery	1	20.0%		0		0.33	1	6.3%		0		0.333	2	9.5%		0		0.108
LOS mother	5.60			5.50		0.859	6.50			5.75		*0.047	6.29			5.69		0.402
Reason for CS																		
arrest of descend	0			0		0.06	1	6.3%		4	12.5%	0.170	1	4.8%		4	9.5%	*0.037
abn. presentation	0			4	40.0%		3	18.8%		5	15.6%		3	14.3%		9	21.4%	
failed induction	0			0			2	12.5%		1	3.1%		2	9.5%		1	2.4%	
fetal distress	0			0			5	31.3%		15	46.9%		5	23.8%		15	35.7%	
patient request	1	20.0%		0			0			1	3.1%		1	4.8%		1	2.4%	
perianal fistula	2	40.0%		0			1	6.3%		0			3	14.3%		0		
Preeclampsia	0			0			3	18.8%		0			3	14.3%		0		
previous CS	0			3	30.0%		1	6.3%		3	9.4%		1	4.8%		6	14.3%	
s/p tear grade ≥3	1	20.0%		1	10.0%		0			0			1	4.8%		1	2.4%	
susp. macrosomia	1	20.0%		1	10.0%		0			0			1	4.8%		1	2.4%	
abn. placentation	0			1	10.0%		0			2	6.3%		0			3	7.1%	
Infection	0			0			0			1	3.1%		0			1	2.4%	
Minutes of CS	40.20			31.30		0.31	32.25			33.41		0.693	34.14			32.90		0.663
Minutes to delivery	4.60			5.30		0.371	5.69			5.75		0.817	5.43			5.64		0.814
Adhesions																		
0	3	60.0%		7	70.0%	1.00	15	93.8%		28	87.5%	0.169	18	85.7%		34	82.9%	0.867
1	2	40.0%		2	20.0%		0			4	12.5%		2	9.5%		6	14.6%	
2	0			1	10.0%		1	6.3%		0			1	4.8%		1	2.4%	
Abnormal placentation																		
No	5	100.0%		9	90.0%	1.00	16	100.0%		31	96.9%	1.000	21	100.0%		40	95.2%	0.548
Previa	0			1	10.0%		0			1	3.1%		0			2	4.8%	
Acrida	0			0			0			0			0			0		
Bleeding	1	20.0%		0		0.33	0			1	3.1%	1.000	1	4.8%		1	2.4%	1
Damage to other organs	0			0			0			0			0			0		
Other complications	0			0			0			0			0			0		
Type of anesthesia																		
1- Spinal	4	80.0%		10	100.0%	0.33	9	56.3%		13	40.6%	*0.019	13	61.9%		23	54.8%	*0.012
2-Conversion Epi.	0			0			3	18.8%		18	56.3%		3	14.3%		18	42.9%	
3- CSE	1	20.0%		0			1	6.3%		0			2	9.5%		0		
4- GA	0			0			0			0			0			0		
5- Conversion RA to GA	0			0			2	12.5%		1	3.1%		2	9.5%		1	2.4%	
6- Epidural	0			0			1	6.3%		0			1	4.8%		0		
Dose in spinal																		
bupivacaine	10.00			10.00			8.83			9.85			9.19			9.91		
Morphine	0.15			0.16			0.16			0.15			0.15			0.15		
Dose in conv. Epidural																		
LIDOCAINE							333.33			364.71			333.33			364.71		
Fentanyl							0.07			0.09			0.07			0.09		
Minutes of anesthesia	68.20			57.30		0.69	53.73			51.91		0.310	57.35			53.19		0.297
Blood products	0			0			0			0			0			0		
mL of fluids	1225.00			750		0.78	1150.00			1175.86		0.109	1166.67			1083.78		0.559
Monitoring																		
Standart	5	100.0%		10	100.0%		14	87.5%		32	100.0%	0.106	19	90.5%		42	100.0%	0.108
A.L.	0			0			2	12.5%		0			2	9.5%		0		
C.L.	0			0			0			0			0			0		
TEE	0			0			0			0			0			0		
Use of tranexamic acid	0			0			0			0			0			0		
Anesthetic complications	0			0			0			1	3.1%	1.000	0			1	2.4%	1
Minutes in recovery room	87.40			152.80		*0.04	186.06			157.56		0.278	162.57			156.43		*0.048
Overnight stay in rec. room	0			0			2	12.5%		2	6.3%	0.592	2	9.5%		2	4.8%	0.59
Transfer to ICU	0			0			1	6.3%		0		0.333	1	4.8%		0		0.333
Weight of newborn	3193.20			3381.45		0.594	2743.94			2978.03		0.336	2850.90			3074.08		0.273
APGAR 1																		
Apgar ≤ 7	0			1	10.0%	1.00	0			5	15.6%	0.154	0			6	14.3%	0.166
Apgar>7	5	100.0%		9	90.0%		16	100.0%		27	84.4%		21	100.0%		36	85.7%	
APGAR 5																		
Apgar ≤ 7	0			0			3	18.8%		3	9.4%	0.386	3	14.3%		3	7.1%	0.391

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Table 5 (continued)

	Elective CS					Urgent CS					Total CS				
	IBD (5)		CONTROL (10)		P	IBD (16)		CONTROL (32)		P	IBD (21)		CONTROL (42)		P
	n/mean	%	n/mean	%		n/mean	%	n/mean	%		n/mean	%	n/mean	%	
Apgar>7	5	100.0%	10	100.0%		13	81.3%	29	90.6%		18	85.7%	39	92.9%	
LOS newborn	5.00		5.75		0.594	15.38		6.03		0.106	12.90		5.96		0.157
Complic. of newborn	1	20.0%	4	40.0%	0.60	9	56.3%	15	46.9%	0.540	10	47.6%	19	45.2%	0.858

CS: cesarean section, LOS: length of stay, A.L: Arterial line, C.L: Central line, TEE: Transesophageal Echocardiography, CSE: combined spinal epidural, GA: General anesthesia, RA: Regional anesthesia.

\* Significance =  $P \leq 0.05$ .

(19.6%) had cesarean section [16 (76.1%) urgent and 5 (23.8%) elective].

Table 1 details the characteristics of the population of women with IBD studied. Out of a total of 107 patients, 71 (66.4%) suffered from Crohn's disease while 36 (33.6%) from Ulcerative Colitis. Regarding those women with Crohn's disease, 26.8% (19/71) of patients with perianal involvement were found. 22.4% (24/107) of the patients were with active disease at the time of conception while 76.6% (82/107) were in remission. Out of those in remission, 42.6% (35/82) had an episode of flare during pregnancy. Additionally, 20.6% (22/107) of patients were being treated with steroids.

When comparing the group of patients with IBD with the general population of women who delivered at the SZMC in the period studied (Table 2), a similar rate of use of epidural analgesia for normal vaginal delivery was observed, around 58%. Additionally, the rate of instrumental delivery was almost identical in both groups, with around a 5% of total vaginal deliveries. In contrast, a significantly higher rate of CS was found in patients with IBD compared to the general population ( $P$ -value 0.019), which coincides with previous studies (8, 10, 11). Similarly, the rate of urgent cesarean section with respect to the total number of cesarean section was significantly higher in the group with IBD ( $P$ -value <0.001).

When observing the group of patients who had NVD, differences were found which were statistically significant, between the patients with IBD and the controls (Table 3). First, a significantly higher frequency of induction of labor was observed in patients with IBD specifically in the subgroup that did not receive epidural analgesia ( $P$ -value 0.003). However, this statistical significance was not found in the subgroup with epidural. The complication rate (tears and postpartum hemorrhage) was significantly higher in the control group compared to the IBD group in those without epidural ( $P$ -value 0.023) while in those with epidural no differences were found. The practice of episiotomy was about twice as frequent in the IBD group with respect to controls in those who received

epidural ( $P$ -value 0.002). Although there were no differences between the groups in the APGAR score, the duration of hospitalization of newborns was longer in patients with IBD compared to controls in the subgroup without epidural ( $P$ -value 0.005).

A comparison was made among patients with IBD between those with and without epidural analgesia (Table 4). A statistically significant difference was found in the duration of labor, which was greater in patients with epidural by almost double ( $P$ -value <0.001). No differences were found in the rate of instrumental delivery as opposed to that demonstrated by other studies in the general population (15).

As mentioned earlier, there were 21 deliveries by cesarean section in patients with IBD. When comparing this group with the controls (Table 5), a greater tendency to the use of spinal anesthesia was observed but no differences were found in the frequency of use of general anesthesia or conversion from regional to general anesthesia. The duration of the surgeries, the duration of anesthesia, the rate of abdominal adhesions, the use of advanced monitoring and the rate of complications such as massive bleeding were similar between the two groups. No cases of damage to adjacent organs were found in the surgeries of patients with IBD, nor were blood products or tranexamic acid used in any patient. There were also no differences in postoperative management (overnight stay or transfer to ICU) between patients with IBD and controls. No significant differences were found in the outcomes of newborns. The only statistically significant differences were found in the hospitalization time of the mothers (greater in patients with IBD but only in the subgroup of urgent cesarean sections,  $P$ -value 0.047) and in the cause of cesarean sections (higher rate of perianal pathology and preeclampsia as causes of C-section in the IBD group).

Finally, in those patients with IBD who underwent cesarean section, a comparison was made between those with urgent and elective surgeries (Table 6). No major differences were found between the groups except for the causes of cesarean section (higher

Table 6  
IBD group, comparison Elective vs Urgent CS.

	IBD				P
	ELECTIVE CS (5)		URGENT CS (16)		
	n/mean	%	n/mean	%	
Gravity	4.80		1.94		
Parity	3.40		0.75		
Week of delivery	38.20		37.19		0.66
Number of newborns					
1	5	100.0%	15	93.8%	0.84
2	0		1	6.3%	
Fever after delivery	1	20.0%	1	6.3%	0.43
LOS mother	5.60		6.50		0.66
Reason for CS					
Arrest of descend	0		1	6.3%	*0.02
Abnormal presentation	0		3	18.8%	
Failed induction	0		2	12.5%	

Table 6 (continued)

		IBD				P
		ELECTIVE CS (5)		URGENT CS (16)		
		n/mean	%	n/mean	%	
	Fetal distress	0		5	31.3%	
	Patient request	1	20.0%	0		
	Perianal fistula	2	40.0%	1	6.3%	
	Preeclampsia	0		3	18.8%	
	Previous CS	0		1	6.3%	
	s/p tear grade 3 or more	1	20.0%	0		
	Suspected macrosomia	1	20.0%	0		
	Abnormal placentation	0		0		
	Infection	0		0		
	Minutes of CS	40.20		32.25		0.275
	Minutes to delivery	4.60		5.69		0.275
	Adhesions					
	0	3	60.0%	15	93.8%	*0.05
	1	2	40.0%	0		
	2	0		1	6.3%	
	Abnormal placentation					
	No	5	100.0%	16	100.0%	
	Previa	0		0		
	Accreta	0		0		
	Bleeding	1	20.0%	0		0.24
	Damage to other organs	0		0		
	Other complications	0		0		
	Type of anesthesia					
	Spinal	4	80.0%	9	56.3%	0.73
	Conversion epidural	0		3	18.8%	
	CSE	1	20.0%	1	6.3%	
	GA	0		0		
	Conversion RA to GA	0		2	12.5%	
	Epidural	0		1	6.3%	
	Dose in spinal					
	Bupivacaine	10.00		8.83		0.371
	Morphine	0.15		0.16		0.768
	Dose in conversion epidural					
	Lidocaine			333.33		
	Fentanyl			0.07		
	Minutes of anesthesia	68.20		53.73		0.142
	Blood products	0		0		0.645
	mL of fluids	1225.00		1150.00		0.645
	Monitoring					
	Standart	5	100.0%	14	87.5%	1.00
	A.L.	0		2	12.5%	
	CVP	0		0		
	TEE	0		0		
	Use of tranexamic acid	0		0		
	Anesthetic complications	0		0		
	Minutes in recovery room	87.40		186.06		0.398
	Overnight stay in recovery room	0		2	12.5%	
	Transfer to ICU	0		1	6.3%	
	Weight of newborn	3193.20		2743.94		0.398
	APGAR 1					
	Apgar ≤ 7	0		0		
	Apgar>7	5	100.0%	16	100.0%	
	APGAR 5					
	Apgar ≤ 7	0		3	18.8%	0.549
	Apgar>7	5	100.0%	13	81.3%	
	LOS newborn	5.00		15.38		0.354
	Complications of newborn	1	20.0%	9	56.3%	0.31

CS: cesarean section, LOS: length of stay, A.L: Arterial line, C.L: Central line, TEE: Transesophageic Echocardiography, CSE: combined spinal epidural, GA: General anesthesia, RA: Regional anesthesia.

\* Significance =  $P \leq 0.05$ .

rate of perianal pathology or previous tears as causes of C-section in the elective group) and a greater score of abdominal adhesions in those with elective surgery.

## Discussion

According to several previous studies, pregnant women with inflammatory bowel disease show an increased incidence of

peripartum complications including preterm birth [6,9], low birth weight [6,14], perinatal hemorrhage [7,10], cesarean section [8,10,11], induction of labor [8], maternal morbidity [8], embolic vein thrombosis [7,12], blood transfusion [12] and intrauterine death [13]. In addition, there exists an increased incidence of advanced maternal age and multiple pregnancy in women with IBD [8], factors associated with increased peripartum morbidity [16].

The increased morbidity and the more common complications of this population on pregnancy and delivery, the increased rate of previous abdominal surgeries and perianal affectation, the use of immunosuppressive therapy and the multisystem involvement that may accompany the disease are all factors that may directly or indirectly affect the anesthetic management of vaginal delivery and cesarean section of this population. This research was carried out with the objective of determining differences in the anesthetic management of delivery of patients with inflammatory bowel diseases. Additionally, we wanted to reexamine differences in obstetric and newborn outcomes in both vaginal delivery and cesarean section of this population.

As in previous studies [8,10,11], we were able to observe a statistically significant higher rate of cesarean sections in the population of patients with IBD and a higher rate of emergency cesarean section. Although there was a greater use of spinal anesthesia in favor of the group of patients with IBD with respect to controls, there were no significant differences in the use of general anesthesia or in the conversion of regional to general anesthesia. Despite a theoretical risk of a longer duration of surgeries and anesthesia of patients with IBD (due to the existence of adhesions from previous surgeries [2] or because of the underlying disease) no major differences were observed. Similarly, a higher rate of surgical or anesthetic complications in cesarean sections, use of blood products, invasive monitoring or the need for postoperative stay in the ICU was not observed. Therefore, it can be said that anesthesiologists can plan their anesthetic management of cesarean sections of patients with IBD in a similar way as they would do with any healthy parturient. Since operative times are similar, spinal anesthesia is a reasonable option especially if epinephrine is added to the injected solution which has been shown to increase the duration of the sensory block [17]. It should be remembered that some of these patients are on chronic steroid treatment, so they should receive stress doses according to current recommendations [18]. In our study 3 of the 21 patients (14.2%) who underwent CS were taking steroids at the time of delivery. Regarding the use of prophylactic antibiotics, the recommendation is the same as for healthy patients except in those patients, who for some reason have been hospitalized for more than 72 h, in which case it is recommended the extension of the antibiotic spectrum according to the advice from infectious disease specialist [19].

As for the vaginal delivery of patients with IBD there are a few points that deserve to be mentioned. The rate of epidural analgesia was similar to the general population. A higher frequency of induction of labor was identified in patients with IBD compared to controls, specifically in the subgroup that did not receive epidural analgesia. However, this difference was not noticed in the subgroup that did receive epidural. This suggests that epidural analgesia was offered to all parturients who required induction but those with IBD consented less to the procedure.

As shown by previous studies [7], no major differences were observed in the rate of complications of vaginal delivery (tears and postpartum hemorrhage) in patients with IBD and in cases where differences did exist, it was in favor of patients with IBD.

The practice of episiotomy was greater in patients with IBD, especially in the subgroup that received epidural analgesia. The cause of this is unclear although it could be hypothesized that it was the product of a theoretical fear of a higher risk of vaginal lacerations in patients with perianal inflammatory changes. However, the rate of complications was not higher in patients with IBD even in those who did not receive episiotomy, which suggests that a standard practice of episiotomy in patients with IBD should be questioned. This has also been remarked in another study [20].

In contrast to prior studies [6,9], there were no differences in neonatal outcomes including APGAR scores and rate of

complications, among those born to mothers with IBD and the healthy controls. Although there was a statistically significant difference in the duration of hospitalization (2.8 days vs. 2.4 days), it is unlikely that this has any clinical relevance.

The duration of delivery of patients with IBD who received epidural analgesia compared to those who did not, was substantially longer than that observed in previous studies [15,21,22]. This may be due to the fact that randomization of the groups was not carried out and therefore it cannot be ruled out that patients with a slower progress of labor requested more epidural analgesia.

## Conclusion

In this retrospective case control study, we observed that the peripartum anesthetic management of patients with Inflammatory Bowel Diseases does not significantly differ from parturients without this pathology. We, therefore, conclude that based on our study anesthesiologists may conduct their anesthetic management in these patients as they would in a general healthy obstetrical population.

## Authors' contributions

A Freundlich: Protocol development, Data collection, Data analysis, Manuscript writing. E Gozal: Protocol development, Data collection, Data analysis, Manuscript writing. S Grisaru-Granovsky: Protocol development, Data analysis, Manuscript editing. A Grass: Manuscript editing. A Bar-Gil Shitrit: Protocol development, Data analysis, Manuscript editing. A Iosco: Protocol development, Data Management, Data analysis, Manuscript writing and editing.

## Declaration of competing interest

All authors declare no conflict of interest.

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