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Intestinal endometriosis amongst other extra-pelvic endometriosis foci presenting as acute/subacute bowel obstruction in women of reproductive age: a retrospective case series study

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Abstract

Background This study aimed to investigate the prevalence and clinicopathological correlates of intestinal endometriosis, amongst other extra-pelvic endometriosis foci, presenting as bowel obstruction in general surgery practice.

Methods A total of 23 female patients (mean ± SD age: 34.9 ± 6.5 years) who underwent abdominal surgery for acute bowel obstruction and received histopathological diagnosis of endometriosis were included in this retrospective case-series study. Data on patient characteristics, obstetric history, preoperative laboratory and imaging findings, preoperative provisional diagnosis, type of surgical intervention and the pathological diagnosis, and postoperative outcomes were recorded.

Results Definitive diagnoses on histopathological work-up involved intestinal endometriosis (52.2%), scar endometriosis (26.0%), ovarian endometriosis (13.0%) and inguinal endometriosis (8.7%). Postoperative complication, reoperation and recurrence rates were 8.7%, 8.7%, and 13.0%, respectively. Intestinal endometriosis, when compared to other extra-pelvic endometriosis foci (scar and inguinal), was associated with significantly higher preoperative platelet counts (332.0(284.0-528.0)vs. 239.0(223.0-370.0) 10^3/μL, $p = 0.010$), lower albumin levels (4.0(2.7–4.7) vs. 4.5(4.2–4.9) g/dL, $p = 0.029$), higher rates of preoperative CT utilization (91.7% vs. 0.0%, $p < 0.001$) and emergent surgery (83.3% vs. 0.0%, $p = 0.001$) and longer LOS (median 4.5 (1.0–26.0) vs. 1.0(1.0–1.0) days, $p = 0.001$) along with a non-significant tendency for higher postoperative complication (16.7% vs. 0.0%) and ICU stay (25.0% vs. 0.0%) rates.

Conclusion Our findings revealed intestinal endometriosis, predominantly in the terminal ileum/appendix, was the most common extra-pelvic cause of acute bowel obstruction. The scar endometriosis, inguinal endometriosis and ovarian endometriosis appeared to be other potential but less prevalent aetiologies in this setting.

Keywords Bowel obstruction, Abdominal surgery, Extra-pelvic endometriosis, Intestinal endometriosis

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Background

Endometriosis is a benign gynaecological disease defined as the presence of endometrial tissue outside the uterine cavity, predominantly in the pelvic compartment (ovaries, external surface of the uterus, fallopian tubes, ligaments of the uterus) [1–3].

However, endometriosis foci can also be found at the level of intraperitoneal (large intestine, small intestine, and appendix) or extraperitoneal (inguinal region, abdominal scars after gynaecological surgery and caesarean section) extra-pelvic organs [3–5].

The bowel is the most affected extra-pelvic location, and intestinal endometriosis comprises 3–37% of all endometriosis cases, which involves rectosigmoid junction (50–90%) in most cases, followed by ileocecal region, appendix and other colon and small bowel segments [2, 6–8].

The acute bowel obstruction due to intestinal endometriosis foci is a very rare event with a reported prevalence of 0.1–0.7%, while it often requires urgent medical attention due acute abdominal inflammation and bowel obstruction or perforation [2, 3, 8–12].

Indeed, surgical intervention is considered to be both diagnostic and therapeutic in patients with bowel obstruction secondary to intestinal endometriosis, due to non-specificity of clinical manifestations, biological tests and imaging modalities in diagnosing intestinal endometriosis [13, 14]. Therefore, the final diagnosis is obtained only after surgical resection and histopathological examination [13–16].

Besides intestinal endometriosis, endometriosis foci in extraperitoneal organs such as inguinal region or abdominal scars after gynaecological surgery and caesarean section may also cause bowel obstruction, in accordance with the extrinsic aetiologies of bowel obstruction (adhesions, hernia) [3–5, 17].

The pathophysiology of intestinal endometriosis is complex with a multifaceted interplay of factors, while bowel obstruction in the setting of intestinal endometriosis remains largely unexplored due to its rarity with limited data in the literature, mostly including case reports [2, 3, 5, 8, 9, 12, 13, 15, 16, 18].

This retrospective case series study aimed to investigate the prevalence and clinicopathological correlates of intestinal endometriosis, amongst other extra-pelvic endometriosis foci, presenting as acute bowel obstruction in general surgery practice.

Methods

Study population

A total of 23 female patients (mean±SD age: 34.9±6.5 years) who underwent abdominal surgery for acute or subacute bowel obstruction and received the diagnosis of endometriosis after histopathological examination of resection specimens, local excisions and biopsies were included in this retrospective case-series study. Women of reproductive age (15–49 years) who underwent emergent abdominal surgery for acute bowel obstruction (ileus plus acute abdomen) and those who underwent elective abdominal surgery for subacute bowel obstruction (ileus without acute abdomen - not resolved under observation and medical treatment) were included in the study.

This study was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the Bursa Uludag University Clinical Research Ethics Committee (Date of Approval: 08.07.2024, Protocol No: 2024-10-6). Written informed consent was obtained from each subject.

Assessments

Data on patient characteristics (age, body mass index [BMI], the American Society of Anaesthesiologists [ASA] score), obstetric history (previous pregnancy and delivery method, gravidity, parity, use of assisted reproductive technology [ART], previous endometriosis history), preoperative laboratory and imaging findings, preoperative provisional diagnosis, timing of surgery (elective, emergent), type of surgical intervention and the pathological diagnosis related to type of endometriosis were recorded in each patient. Postoperative outcome parameters included the length of hospital stay (LOS), intensive care unit (ICU) stay, postoperative complications, and follow up data on stoma closure, reoperation, and recurrence rates (based on detection of further endometriosis lesions).

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY). Chi-square ($\chi 2$) test was used for the comparison of categorical data, while Mann-Whitney U test was used to compare two independent non-normally distributed variables. Data were expressed as mean±standard deviation (SD), median (min-max) and percent (%) where appropriate. $p<0.05$ was considered statistically significant.

Results

Demographic and obstetric characteristics

Mean±SD age of female participants was 34.9±6.5 years (range, 26.0 to 47.0 years). Previous pregnancy was evident in 14(60.9%) patients, and the delivery method was caesarean section (C/S) in 30.4% of them. A previous history for endometriosis was noted in 8(34.8%) patients (Table 1).

Table 1 Demographic, obstetric, preoperative and postoperative characteristics ($n=23$)

Patient characteristics		
Age (year)	mean ± SD	34.9 ± 6.5
	median(min-max)	36.0(26.0–47.0)
BMI (kg/m^2), median(min-max)		24.9(17.3–36.8)
ASA score ($n=21$), n(%)	1	18(78.3)
	2	3(13.0)
Obstetric history		
Previous pregnancy, n(%)	Yes	14(60.9)
	No	9(39.1)
Delivery method ($n=12$), n(%)	C/S	7(30.4)
	NSVD	5(21.7)
ART usage, n(%)		4(17.4)
Gravidity, median(min-max)		1.0(0.0–6.0)
Parity, median(min-max)		1.0(0.0–6.0)
Previous history of endometriosis, n(%)	Yes	8(34.8)
	No	15(65.2)
Preoperative laboratory findings, **median(min-max)**		
WBC (10^3/μL)		8.4(4.6–19.0)
Hb (g/dL)		11.9(8.9–13.8)
Platelet (10^3/μL)		307.5(223–528)
Urea (mg/dL)		20.0(9.0–48.0)
Creatinine (mg/dL)		0.6(0.4-1.0)
AST(U/L)		15.5(9.0–55.0)
ALT(U/L)		14.0(7.0–64.0)
Albumin (g/dL)		4.2(2.7–4.9)
Preoperative imaging, **n(%)**		
Preoperative CT		12(52.2)
Preoperative US		11(47.8)
Preoperative provisional diagnosis, **n(%)**		
Obstructive ileus		5(21.7)
Mass at C/S incision site		5(21.7)
Acute abdomen		4(17.4)
Inguinal mass-hernia		4(17.4)
Colonic endometriosis		1(4.3)
Pelvic abscess		1(4.3)
Perforation		1(4.3)
Hartmann closure		1(4.3)
Psoas abscess		1(4.3)
Surgery		
Type of surgery, **n(%)**		
Elective		11(47.8)
Emergent		12(52.2)
Stoma, **n(%)**		9(39.1)
Pathological diagnosis, **n(%)**		
Intestinal endometriosis		12(52.2)
Scar endometriosis		6(26.0)
Ovarian endometriosis		3(13.0)
Inguinal endometriosis		2(8.7)
Postoperative outcome		
LOS (day), median(min-max)		4.0(1.0–26.0)
ICU stay, n(%)		3(13.0)
Postoperative complication, n(%)		2(8.7)
Reoperation, n(%)		2(8.7)
Stoma closure, n(%)		5(21.7)

Table 1 (continued)

Recurrence, n(%)	3(13.0)
Follow-up time (month), median(min-max)	11.7(0.3–82.7)

BMI: body mass index; C/S: cesarean section; NSVD: normal spontaneous vaginal delivery; WBC; Whie blood cell; AST: Aspartate transaminase; ALT: Alanine transaminase; CT: computerized tomography; US: ultrasound; LOS: length of hospital stay; ICU: intensive care unit

Preoperative work-up and provisional diagnoses

Preoperative imaging included computerized tomography (CT) in 52.2% of patients, while 47.8% of patients were evaluated with preoperative ultrasound (US) (Table 1).

Preoperative imaging revealed no specific findings other than intestinal distension (on US) and transition zones related to ileus (on CT). Overall imaging findings were consistent with the diffuse bowel wall thickening on individual intestinal segments and narrowing of the intestinal lumen, the implantations on bowel wall in rectosigmoid region, cecum, appendix and distal ileum, the transition zone in the obstructed areas and the adhesion particularly between the rectum and vaginal fornix.

The most common preoperative provisional diagnoses were obstructive ileus (21.7%), mass at C/S incision site (21.7%), acute abdomen (17.4%), and inguinal mass-hernia (17.4%) (Table 1).

Surgery and pathological diagnosis

Overall, emergent and elective surgery rates were 52.2% and 47.8%, respectively. The final pathological diagnosis included intestinal endometriosis in 12(52.2%) patients, scar endometriosis in 6(26.0%) patients, ovarian endometriosis in 3(13.0%) patients and inguinal endometriosis in 2(8.7%) patients (Table 1).

Postoperative outcome

Median LOS was 4.0 days (range, 1.0 to 26.0 days), while 13.0% of patients needed ICU stay. Postoperative complications (superficial wound infection) were noted in 2(8.7%) patients. During median 11.7 months (range, 0.3 to 82.7 months) of follow-up, the reoperation (due to prolonged postoperative ileus), stoma closure and recurrence (extra-pelvic endometriosis foci as confirmed by surgical pathology) rates were 8.7%, 21.7% and 13.0%, respectively (Table 1).

Case-wise details

Case-wise details on patient characteristics, preoperative provisional diagnoses, surgical intervention, pathological diagnosis and postoperative outcome are provided in Table 2.

Distribution of study parameters by endometriosis foci

Overall, there was a tendency for increased likelihood of certain clinical, surgical and outcome variables across endometriosis foci, including intestinal endometriosis (utilization of preoperative CT, emergent surgery, ICU stay, prolonged LOS, postoperative complication and recurrence), scar endometriosis (previous C/S delivery, recurrence and reoperation) and ovarian endometriosis (utilization of preoperative CT, lower preoperative albumin levels and platelet counts, emergent surgery, prolonged LOS) (Table 3).

Study parameters with respect to extra-pelvic endometriosis foci

Intestinal endometriosis, when compared to other extra-pelvic endometriosis foci (scar and inguinal), was associated with significantly higher preoperative platelet counts (median(min-max) 332.0(284.0-528.0) vs. 239.0(223.0-370.0) 10^3/μL, $p=0.010$), lower albumin levels (median(min-max) 4.0(2.7–4.7) vs. 4.5(4.2–4.9) g/dL, $p=0.029$), higher rates of preoperative CT utilization (91.7% vs. 0.0%, $p<0.001$) and emergent surgery (83.3% vs. 0.0%, $p=0.001$) and longer LOS (median(min-max) 4.5 (1.0–26.0) vs. 1.0(1.0–1.0) days, $p=0.001$) along with a non-significant tendency for higher rate of postoperative complications (16.7% vs. 0.0%) and ICU stay (25.0% vs. 0.0%) (Table 4).

No significant difference was noted between intestinal endometriosis and inguinal/scar endometriosis groups in terms of patient age, BMI, preoperative US utilization, and previous history for endometriosis (41.7% and 25.0%, respectively) (Table 4).

Discussion

Our findings emphasize consideration of extra-pelvic endometriosis, particularly the intestinal endometriosis, as a potential cause of bowel obstruction leading to abdominal surgery in general surgery practice. Surgical pathology remains the primary diagnostic option. Other than higher platelet counts and lower serum albumin levels and higher prevalence of nulliparous women in case of intestinal endometriosis, patient profile or preoperative laboratory investigation was not helpful in differentiating subtypes (intestinal, inguinal or scar) of extra-pelvic endometriosis. Intestinal endometriosis was associated with higher rates of emergent surgery, ICU stay and postoperative complications and a longer LOS, compared to other extra-pelvic endometriosis foci (scar or inguinal).

Acute bowel obstruction secondary to intestinal endometriosis is a diagnostically challenging condition due to nonspecific clinical presentation and lack of specific laboratory or imaging measures [2, 3, 12]. Therefore,

Table 2 Case-wise details

Case #	Previous endometriosis	Preoperative provisional diagnosis	Surgical intervention	Pathology result	POC	REO	REC
Intestinal endometriosis							
1	Yes	colonic endometriosis	anterior resection	Endometriosis, colonic wall			
2	No	distension + abdominal pain	right hemicolectomy	Endometriosis			
3	No	obstructive ileus	ileocecal resection + double-barreled ostomy	Intestinal endometriosis			
4	Yes	acute abdomen + sepsis	ileocecal resection + double-barreled ostomy	Endometriosis foci			
5	No	ileus	ileocecal resection + double-barreled ostomy	Endometriosis + edema and congestion, intestinal tissue			
6	Yes	perforation	Hartmann's procedure	Endometriosis, rectal wall	Yes		Yes
7	No	obstructive ileus	anterior resection + protective ileostomy	Endometriosis, intestinal tissue			
8	Yes	obstructive ileus	ultralow anterior resection + protective ileostomy	Disseminated endometriosis foci, intestinal tissue	Yes	Yes	Yes
9	No	acute appendicitis	laparoscopic appendectomy	Suppurative appendicitis + appendectomy Endometriosis, right and left pelvic peritoneum, biopsy			
10	No	Hartmann's closure	laparotomy	Endometriosis, rectum, biopsy material			
11	No	psoas abscess	interval laparoscopic appendectomy	Suppurative appendicitis + Endometriosis,			
12	Yes	operated ileocolic resection + acute abdomen	double-barrel ostomy	Endometriosis			
Scar endometriosis							
13	No	C/S incision mass	mass resection	Endometriosis			
14	No	umbilical hernia + C/S incision mass	hernia repair + mass resection	Endometriosis			
15	Yes	C/S incision mass	mass resection	Endometriosis			
16	No	umbilical hernia	umbilical mass excision	Endometriosis foci, dermis		Yes	Yes
17	No	cholelithiasis + C/S incision mass	laparoscopic cholecystectomy + mass excision	Endometriosis			
18	No	C/S incision mass	mass resection	Endometriosis, suprapubic below incision, biopsy			
Ovarian endometriosis							
19	No	pelvic abscess	left tubo-ovarian abscess drainage + sigmoid loop ostomy + drainage + irrigation	Endometriosis, left ovary			
20	Yes	inguinal hernia	transabdominal preperitoneal (TAPP) inguinal hernia repair + right ovarian cyst excision	Endometriosis, right ovary			
21	No	acute abdomen	bilateral ovarian cyst excision	Endometriosis cyst, ovary			
Inguinal endometriosis							
22	No	Right inguinal mass	right inguinal mass resection	Endometriosis			
23	Yes	Right inguinal hernia	inguinal hernia repair	Endometriosis, right inguinal hernia, excisional biopsy			

C/S: Cesarean section; POC: postoperative complication; REO: reoperation; REC: recurrence

definitive diagnosis is based on histopathological confirmation after surgical resection [2, 3, 12, 13, 19, 20].

The intestinal endometriosis (57.7%) was the leading pathological diagnosis in our cohort, followed by scar endometriosis (23.1%), ovarian endometriosis (11.5%) and inguinal endometriosis (7.7%). Previous studies also revealed the bowel as the most affected extra-pelvic site which comprises 3–12% of extra-pelvic endometriosis, mostly in the rectosigmoid junction (50–90%) [6, 9, 14, 21, 22]. However, while the intestinal involvement in endometriosis is common, it rarely causes acute intestinal obstruction and, in this setting, endometriosis has a predilection to obstruct the terminal ileum/appendix which almost always necessitates surgical resection [5, 7, 8, 12,

Table 3 Study parameters by endometriosis foci

	Intestinal endometriosis (*n* = 12)	Scar endometriosis (*n* = 6)	Inguinal endometriosis (*n* = 2)	Ovarian endometriosis (*n* = 3)
Age (year), median(min-max)	36.0(26.0–47.0)	35.0(27.0–42.0)	36.5(30.0–43.0)	34.0(28.0–41.0)
Previous pregnancy (*n* = 14), n(%)	6(40.0)	6(100.0)	1(50.0)	1(33.3)
C/S delivery (*n* = 7), n(%)	3(25.0)	4(66.7)	0(0.0)	0(0.0)
Previous endometriosis (*n* = 8), n(%)	5(41.7)	1(16.7)	1(50.0)	1(33.3)
Preoperative CT (*n* = 12), n(%)	9(75.0)	0(0.0)	0(0.0)	3(100.0)
Preoperative US (*n* = 11), n(%)	5(41.7)	3(50.0)	1(50.0)	2(66.7)
Albumin (g/dL), median(min-max)	4.1(2.7–4.7)	4.6(4.4–4.9)	4.3(4.2–4.3)	2.9(2.5–3.2)
Platelet (10^3/μL), median(min-max)	345.0(284.0-528.0)	239.0(217.0-381.0)	229.5(185.0-274.0)	248(66.2–328.0)
Emergent surgery (*n* = 12), n(%)	10(83.3)	0(0.0)	0(0.0)	2(66.7)
Postop complications (*n* = 2), n(%)	2(16.7)	0(0.0)	0(0.0)	0(0.0)
ICU stay (*n* = 3), n(%)	3(25.0)	0(0.0)	0(0.0)	0(0.0)
LOS (day), median (min-max)	4.5(1.0–26.0)	1.0(1.0–1.0)	1.0(1.0–1.0)	7.0(4.0–12.0)
Reoperation (*n* = 2), n(%)	1(8.3)	1(16.7)	0(0.0)	0(0.0)
Recurrence (*n* = 3), n(%)	2(16.7)	1(16.7)	0(0.0)	0(0.0)

BMI: body mass index; C/S: cesarean section; CT: computerized tomography; US: ultrasound; postop: postoperative; LOS: length of hospital stay; ICU: intensive care unit

23–26]. Notably, terminal ileum/appendix appeared to be predominantly affected region in our patients with intestinal endometriosis, which also explains the presentation characteristics such as bowel obstruction, perforation, acute appendicitis and intussusception, unique to terminal ileum/appendix involvement [13, 22]. Higher platelet counts and lower serum albumin levels in our patients with intestinal endometriosis are typical findings in the setting of bowel obstruction, which reveal systemic inflammation and impaired nutritional status [27].

Indeed, the rectosigmoid involvement is suggested to reflect a tendency for more extensive pelvic and intestinal involvement in patients with known genital endometriosis (ovarian endometriosis in particular), rather than being a frequent site of involvement in case of an incidentally detected isolated intestinal endometriosis [24, 28]. Pathological confirmation of ovarian endometriosis in our three cases seems notable in this regard, supporting the consideration of ovarian endometriosis as a marker for more extensive pelvic and intestinal disease [28]. Notably, higher utilization of preoperative CT, lower preoperative albumin levels, high prevalence of emergent surgery and prolonged LOS were common to both intestinal endometriosis and ovarian endometriosis in our case-series. In fact, given the association of ovarian endometriosis with an increased risk of pelvic and intestinal involvement, involvement of ovaries exclusively by endometriosis without coexistent disease elsewhere is considered a rare event [28]. This emphasizes the likelihood of other pelvic or intestinal disease to be left untreated that if a surgeon identifies and treats only ovarian endometriosis [28].

In a systematic review of 97 case studies involving 107 patients with bowel occlusion due to endometriosis, locations of occlusive endometrial foci were reported to be ileum in 38.3% of the cases, rectosigmoid in 34.5% of the cases, ileocecal junction and the appendix in 14.9% of the cases, and rectum in 10.2% of the cases [3]. Out of 107 patients, 26(24.3%) were previously diagnosed with endometriosis, while the rest (75.7%) were diagnosed with endometriosis in the context of an intestinal occlusion event [3].

Likewise, previous history of endometriosis was evident in one-third of our study population, similarly in intestinal endometriosis and inguinal/scar endometriosis groups. Other studies reported a previous diagnosis of endometriosis in at least half patients with intestinal endometriosis, besides the isolated bowel endometriosis [13, 29–33]. Hence, while most cases with intestinal endometriosis are diagnosed as well as treated with surgery consistent with the nonspecific presentation of the disease, knowledge of pre-existing endometriosis via detailed patient history may help in making clinical decisions for patients [13, 32, 33].

Clinical presentation of extra-pelvic endometriosis is considered highly variable depending on the organ affected, while it is particularly difficult to diagnose preoperatively in case of intestinal endometriosis due to asymptomatic or non-specific presentation with considerable overlap with other clinical gastrointestinal conditions [13, 19].

The preoperative diagnoses (obstructive ileus, acute abdomen, appendicitis, pelvis/psoas abscess, perforation) in our intestinal endometriosis group, support the consideration of intestinal endometriosis to be commonly misdiagnosed as irritable bowel syndrome, acute appendicitis or diverticulitis, inflammatory bowel disease, intestinal carcinoma, or ovarian pathology [13, 34,

Table 4 Study parameters with respect to extra-pelvic endometriosis foci

	Extra-pelvic endometriosis foci		
	Intestinal endometriosis (*n* = 12)	**Inguinal /scar endometriosis (*n* = 8)**	***p* value**
Patient characteristics			
Age (year), median(min-max)	36.0(26.0–47.0)	34.0(27.0–43.0)	0.851
BMI (kg/m^2), median(min-max)	23.0(17.3–32.0)	26.0(18.0-36.8)	0.196
Obstetric history			
Previous pregnancy, n(%)			
Yes (*n* = 13)	6(50.0)	7(87.5)	0.085
No (*n* = 7)	6(50.0)	1(12.5)	
Delivery method, n(%)			
C/S (*n* = 7)	3(25.0)	4(50.0)	0.331
NSVD (*n* = 4)	2(16.7)	2(25.0)	
Previous history of endometriosis, n(%)			
Yes (*n* = 7)	5(41.7)	2(25.0)	0.461
No(*n* = 12)	6(50.0)	6(75.0)	
Preoperative laboratory findings, median(min-max)			
WBC (10^3/μL)	12.1(4.9–17.0)	7.6(4.6–8.9)	0.098
Hemoglobin (g/dL)	11.6(8.9–13.9)	13.0(9.3–13.0)	0.910
Platelet (10^3/μL)	332.0(284.0-528.0)	236.0(223.0-370.0)	**0.010**
Urea (mg/dL)	22.0(15.0–48.0)	17.0(9.0–29.0)	0.120
Creatinine (mg/dL)	0.6(0.4–0.8)	0.6(0.6-1.0)	0.592
AST(U/L)	16.0(9.0–55)	15.0(11.0–25.0)	0.791
ALT(U/L)	15.0(7.0–64.0)	11.0(8.0–38.0)	0.261
Albumin (g/dL)	4.0(2.7–4.7)	4.5(4.2–4.9)	**0.029**
Preoperative imaging, n(%)			
Preoperative CT			
Yes (*n* = 11)	11(91.7)	0(0.0)	**< 0.001**
No (*n* = 9)	1(8.3)	8(100.0)	
Preoperative US			
Yes (*n* = 9)	5(41.7)	4(50.0)	0.714
No (*n* = 11)	7(58.3)	4(50.0)	
Surgery, n(%)			
Elective (*n* = 9)	2(16.7)	7(87.5)	**0.001**
Emergent (*n* = 10)	10(83.3)	0(0.0)	
Postoperative outcome			
LOS (day), median(min-max)	4.5(1.0–26.0)	1.0(1.0–1.0)	**0.001**
Postoperative complications, n(%)			
Yes (*n* = 2)	2(16.7)	0(0.0)	0.241
No (*n* = 17)	10(83.3)	7(87.5)	
ICU stay, n(%)			
Yes (*n* = 3)	3(25.0)	0(0.0)	0.125
No (*n* = 17)	9(75.0)	8(100.0)	
Reoperation, n(%)			
Yes (*n* = 2)	1(8.3)	1(12.5)	0.684
No (*n* = 17)	10(83.3)	7(87.5)	
Recurrence, n(%)			
Yes (*n* = 3)	2(16.7)	1(12.5)	0.928
No (*n* = 8)	5(41.7)	3(37.5)	

BMI: body mass index; C/S: cesarean section; NSVD: normal spontaneous vaginal delivery; WBC; Whie blood cell; AST: Aspartate transaminase; ALT: Alanine transaminase; CT: computerized tomography; US: ultrasound; LOS: length of hospital stay; ICU: intensive care unit
Chi square test, Mann Whitney U test

35]. Hence, definitive diagnosis is often delayed due to variable presentation and symptom overlap prompting the gastrointestinal diagnostic workup and is often made incidentally during surgery or following complications such as bowel obstruction, perforation, or ileocecal intussusceptions [15, 21, 31, 32, 36, 37].

Bowel wall infiltration of endometrial-like tissue leads to activation of inflammatory response that promotes the secretion of cytokines and chemokines, creating a microenvironment that contributes to the development of the ectopic endometrial tissue by disrupting normal apoptosis and promoting localized angiogenesis and neuroagiogenesis, particularly in case of deep infiltrating endometriosis [38, 39]. Accordingly, while deep infiltrating endometriosis can cause intestinal stenosis or occlusion in severe cases, the bowel complaints could be caused not only by occluding bulky lesions but also by angulation of the bowel, wall inflammation or neurological issues [40, 41]. The creation of a mass effect in the intestinal lumen or wall, and the pro-fibrotic nature of endometriosis lesions leading to adhesion or stricture formation are considered likely to be responsible for intestinal obstruction, particularly in case of ileocecal involvement, which necessitates complete diagnostic laparoscopy to rule out multicentric foci and almost always warrants surgical resection [3, 15, 16, 42–44]. Nonetheless, the drawback of diagnostic phase of laparoscopy (risk of additional intestinal injury) or open approach in identifying occult lesion is notable in this regard, limiting the detection of any bowel lesion [45].

Although histopathologic confirmation with surgery remains the gold standard for diagnosis, transvaginal sonography, magnetic resonance imaging (MRI), double contrast barium enema and CT colonography are the key non-invasive imaging modalities for initial assessment to aid in surgical treatment in intestinal endometriosis. Nonetheless, non-invasive imaging may be inconclusive given the large range of potential sites of deep intestinal endometriosis [13, 46–49].

Right hemicolectomy, ileocecal resection, anterior resection with double-barrel ostomy were the leading surgical interventions in our cases with intestinal endometriosis, supporting the consideration of segmental resection and primary anastomosis as the favourable technique in these patients, which allows for a radical removal of intestinal endometriosis and minimizes future risk of recurrences, improves pelvic pain, intestinal symptoms and quality of life [13, 42].

Likewise, in a systematic review of 97 studies involving 107 patients with bowel occlusion due to endometriosis the reported surgical interventions included those performed for ileal obstruction (ileocecal resections, right hemicolectomies, ileal resections, ileotransversostomy), ileocecal obstruction (right hemicolectomies and ileocecal resections) and rectal obstruction (anterior rectal resection in three patients, and rectosigmoid resection), sigmoid colon obstruction (Hartman procedures, hemicolectomy with colostomy, sigmoid colectomies with primary anastomosis, and one sigmoid colostomy) [3].

In a meta-analysis of 49 studies examining surgical treatment of bowel endometriosis, overall endometriosis recurrence rate was estimated to be 10%, with a recurrence rate of 5.8% in case of bowel resection with anastomosis [50]. Overall rates for postoperative complication (11.5%), reoperation (7.7%) and recurrence (11.5%) in our patients seem notable in this regard, which appeared to differ across the type of extra-pelvic endometriosis foci, with higher likelihood of postoperative complications and recurrence in case of intestinal endometriosis and higher rate of recurrence and reoperation in case of scar endometriosis.

Hence, our findings emphasize that extra-pelvic endometriosis foci should be suspected in women presenting with bowel obstruction, particularly the intestinal endometriosis in nulliparous women and the scar endometriosis in those with previous C/S delivery [3, 13, 14, 22, 51]. Although reasons for this were not addressed in the current study, increased likelihood of endometriosis in nulliparous women may relate to the risk of increased number of lifelong ovulatory cycles, besides the adverse impact of endometriosis on fertility of the affected women [52–55].

Ovarian endometriosis was previously described in patients with ileal, ilecocecal or sigmoid colon obstructions, while rectal endometriosis was associated with extensive lesions in the uterus and ovaries [2, 3, 56]. Hence, the likelihood of ovarian endometriosis to be associated with intestinal disease should also be considered, alongside the higher risk of emergent surgery and prolonged LOS in case of both intestinal and ovarian endometriosis. Accordingly, it seems critical to consider endometriosis a gastrointestinal pathology as much as a gynaecological one, and the clinical awareness of gastroenterology physicians and surgeons in this regard seems essential for obtaining optimum patient outcomes through timely diagnosis and appropriate surgical planning, reducing patient morbidity and improving quality of life [16, 31, 57].

The small sample size, which reduces generalizability and possibility of having robust statistical results in endometriosis foci subgroup analyses, and the study's retrospective nature, which may introduce selection bias, are the major limitations of our study. In addition, the absence of a control group makes it difficult to contextualize the findings or determine causality. Nevertheless, despite these certain limitations, given the rarity of bowel obstruction due to endometriosis, presenting detailed

analysis of endometriosis foci in a case-series comprising 23 patients with abdominal surgery for bowel obstruction, our findings make a valuable contribution to the existing literature.

Conclusions

In conclusion, our findings revealed intestinal endometriosis, predominantly in the terminal ileum/appendix, was the most common extra-pelvic cause of acute bowel obstruction. The scar endometriosis, inguinal endometriosis and ovarian endometriosis appeared to be other potential but less prevalent aetiologies in this setting. Accordingly, extra-pelvic endometriosis foci, particularly intestinal endometriosis in nulliparous women and scar endometriosis in those with previous C/S delivery, should be considered as a rare differential in acute bowel obstruction presentations by women of childbearing age in the general surgery practice. Our findings also emphasize the potential association of intestinal and ovarian endometriosis with increased risk of emergent surgery and prolonged LOS, and the higher risk of postoperative recurrence in case of intestinal and scar endometriosis. In this regard, further large-scale studies are necessary to identify clinical risk factors or potential biomarkers for specific endometriosis foci in order to develop diagnostic tools which would possibly reduce the need for surgeries and improve patient quality of life.

Abbreviations

ART	Assisted reproductive technology
ASA	American Society of Anesthesiologists
BMI	Body mass index
C/S	Cesarean section
CT	Computerized tomography
ICU	Intensive care unit
LOS	Length of hospital stay
MRI	Magnetic resonance imaging
SD	Standard deviation
US	Ultrasound

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Author contributions

EG: Conceptualization; methodology; data curation; formal analysis; investigation; project administration; writing-original draft preparation. OI: Methodology; Data curation; formal analysis; investigation. NU: Methodology; Data curation; formal analysis; investigation. AS: Data curation; formal analysis; investigation. MS: Data curation; formal analysis; investigation. TY: Methodology; investigation; writing- review & editing; supervision.

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Data availability

The data supporting the findings of this study are available within the article, further inquiries can be directed to the corresponding author.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the Bursa Uludag University Clinical Research Ethics Committee (Date of Approval: 08.07.2024, Protocol No: 2024-10-6). Written informed consent was obtained from each subject.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Benagiano G, Brosens I, Lippi D. The history of endometriosis. Gynecol Obstet Invest. 2014;78(1):1–9.
2. Alexandrino G, Lourenço LC, Carvalho R, Sobrinho C, Horta DV, Reis J. Endometriosis: a Rare cause of large bowel obstruction. GE Port J Gastroenterol. 2018;25(2):86–90.
3. Mușat F, Păduraru DN, Bolocan A, Constantinescu A, Ion D, Andronic O. Endometriosis as an Uncommon Cause of Intestinal Obstruction-A Comprehensive Literature Review. J Clin Med. 2023;12(19):3.
4. Ion D, Bolocan A, Pituru SM, Mateoiu PE, Musat F, Andronic O, et al. Concomitant inguinal endometriosis and groin hernia—case report. Arch Balk Med Union. 2017;52(4):462–6.
5. Sali PA, Yadav KS, Desai GS, Bhole BP, George A, Parikh SS, et al. Small bowel obstruction due to an endometriotic ileal stricture with associated appendiceal endometriosis: a case report and systematic review of the literature. Int J Surg Case Rep. 2016;23:163–8.
6. López Carrasco A, Hernández Gutiérrez A, Hidalgo Gutiérrez PA, Rodríguez González R, Marijuán Martín JL, Zapardiel I, et al. Ileocecal endometriosis: diagnosis and management. Taiwan J Obstet Ggynecol. 2017;56(2):243–6.
7. Veeraswamy A, Lewis M, Mann A, Kotikela S, Hajhosseini B, Nezhat C. Extragenital Endometriosis. Clin Obstet Gynecol. 2010;53(2):449–66.
8. Torralba-Morón A, Urbanowicz M, Ibarrola-De Andres C, Lopez-Alonso G, Colina-Ruizdelgado F, Guerra-Vales JM. Acute Small Bowel obstruction and small bowel perforation as a clinical debut of intestinal endometriosis: a report of four cases and review of the literature. Intern Med. 2016;55(18):2595–9.
9. Allan Z. A case of endometriosis causing acute large bowel obstruction. Int J Surg Case Rep. 2018;42:247–9.
10. Kobayashi K, Yamadera M, Takeo H, Murayama M. Small bowel obstruction caused by appendiceal and ileal endometriosis: a case report. J Surg Case Rep. 2022;2022(6):rjac282.
11. Doh K, Thiam I, Ka S, Dial C, Woto-Gaye G. Rectal endometriosis: an exceptional etiology of acute intestinal occlusion. Ann Pathol. 2016;36(6):412–4.
12. Slesser AA, Sultan S, Kubba F, Sellu DP. Acute small bowel obstruction secondary to intestinal endometriosis, an elusive condition: a case report. World J Emerg Surg: WJES. 2010;5:27.
13. Dhannoon A, Bajwa A, Kunna M, Canney A, Nugent E. Beyond borders: a case report of small bowel obstruction secondary to undiagnosed florid endometriosis. Int J Surg Case Rep. 2022;93:106994.
14. Hirata T, Koga K, Osuga Y. Extra-pelvic endometriosis: a review. Reprod Med Biol. 2020;19(4):323–33.
15. Shetty S, Varma D. Rare case of ileocecal obstruction secondary to endometriosis presenting for the First Time. Cureus. 2021;13(8):e17074.
16. Galazis N, Arul D, Wilson J, Pisal N. Bowel endometriosis. BMJ Case Rep. 2014;2014:bcr2013202140.
17. Wang E, Humphries A, Johnson LS. Small bowel obstruction due to internal hernia through sigmoid epiploica. J Surg Case Rep. 2019;2019(1):rjy342.
18. Yong PJ, Bedaiwy MA, Alotaibi F, Anglesio MS. Pathogenesis of bowel endometriosis. Best practice and research. Clin Obstet Gynaecol. 2021;71:2–13.
19. Sánchez Cifuentes Á, Candel Arenas MF. Albarracín Marín-Blázquez A. Intestinal endometriosis. Our experience. Rev Esp Enferm Dig. 2016;108(8):524–5.
20. Ruiz Marín M, Parra Baños PA, González Valverde FM, Rodenas Moncada J, Candel Arenas MF, Méndez Martínez M, et al. Appendiceal intussusception

resulting from endometriosis presenting as acute appendicitis. Am Surg. 2010;76(8):906–8.
21. Abrão MS, Petraglia F, Falcone T, Keckstein J, Osuga Y, Chapron C. Deep endometriosis infiltrating the recto-sigmoid: critical factors to consider before management. Hum Reprod Update. 2015;21(3):329–39.
22. Koyama R, Aiyama T, Yokoyama R, Nakano S. Small bowel obstruction caused by Ileal Endometriosis with Appendiceal and Lymph Node involvement treated with single-incision laparoscopic surgery: a Case Report and Review of the literature. Am J Case Rep. 2021;22:e930141.
23. Teke Z, Aytekin FO, Atalay AO, Demirkan NC. Crohn's disease complicated by multiple stenoses and internal fistulas mimicking small bowel endometriosis. World J Gastroenterol. 2008;14(1):146–51.
24. Vercellini P, Sergenti G, Buggio L, Frattaruolo MP, Dridi D, Berlanda N. Advances in the medical management of bowel endometriosis. Best practice and research. Clin Obstet Gynaecol. 2021;71:78–99.
25. Fedele L, Berlanda N, Corsi C, Gazzano G, Morini M, Vercellini P. Ileocecal endometriosis: clinical and pathogenetic implications of an underdiagnosed condition. Fertil Steril. 2014;101(3):750–3.
26. Karaman K, Pala EE, Bayol U, Akman O, Olmez M, Unluoglu S, et al. Endometriosis of the terminal ileum: a diagnostic dilemma. Case Rep Pathol. 2012;2012:7420–35.
27. Bildik B, Çekmen B, Atiş ŞE, Günaydın YK, Dorter M. Evaluation of the relationship between Hemoglobin, Albumin, lymphocyte, platelet (HALP) score and treatment modality and mortality in patients with ileus. Ulus Travma Acil Cerrahi Derg. 2023;29(12):1351–6.
28. Redwine DB. Ovarian endometriosis: a marker for more extensive pelvic and intestinal disease. Fertil Steril. 1999;72(2):310–5.
29. Bascombe NA, Naraynsingh V, Dan D, Harnanan D. Isolated endometriosis causing sigmoid colon obstruction: a case report. Int J Surg Case Rep. 2013;4(12):1073–5.
30. Peacock T, Harrison W, Limmer A, Di Sano S, Wong KS. Ileal endometriosis: a rare cause of multifocal small bowel strictures. ANZ J Surg. 2022;92(7–8):1914–5.
31. Ha K, Marks D, Bennett RD, Mikhail E. Deep endometriosis of the terminal Ileum presenting with cyclic recurrent small bowel obstruction. Cureus. 2023;15(9):e45636.
32. Gillen N, Kovacs T, Leahy J. Diagnosis and management of small bowel obstruction in the ileum caused by endometriosis: a case report. Case Rep Womens Health. 2023;38:e00522.
33. Mabrouk M, Raimondo D, Cofano M, Cocchi L, Paradisi R, Seracchioli R. Diagnosis and treatment of uncommon ileal endometriosis: a case report and literature review. Facts Views Vis ObGyn. 2021;13(4):405–10.
34. Yantiss RK, Clement PB, Young RH. Endometriosis of the intestinal tract: a study of 44 cases of a disease that may cause diverse challenges in clinical and pathologic evaluation. Am J Surg Pathol. 2001;25(4):445–54.
35. Remorgida V, Ferrero S, Fulcheri E, Ragni N, Martin DC. Bowel endometriosis: presentation, diagnosis, and treatment. Obstet Gynecol Surv. 2007;62(7):461–70.
36. Rodriguez-Lopez M, Bailon-Cuadrado M, Tejero-Pintor FJ, Choolani E, Fernandez-Perez G, Tapia-Herrero A. Ileocecal intussusception extending to left colon due to endometriosis. Ann R Coll Surg Eng. 2018;100(3):e62–3.
37. Saunders PT, Horne AW. Endometriosis: etiology, pathobiology, and therapeutic prospects. Cell. 2021;184(11):2807–24.
38. Machairiotis N, Vasilakaki S, Thomakos N. Inflammatory mediators and Pain in Endometriosis: a systematic review. Biomedicines. 2021;9(1):54. https://doi.org/10.3390/biomedicines9010054.
39. Anaf V, El Nakadi I, De Moor V, Chapron C, Pistofidis G, Noel JC. Increased nerve density in deep infiltrating endometriotic nodules. Gynecol Obstet Invest. 2011;71(2):112–7. https://doi.org/10.1159/000320750.
40. Mabrouk M, Ferrini G, Montanari G, Di Donato N, Raimondo D, Stanghellini V, Corinaldesi R, Seracchioli R. Does colorectal endometriosis alter intestinal functions? A prospective manometric and questionnaire-based study. Fertil Steril. 2012;97(3):652–6. https://doi.org/10.1016/j.fertnstert.2011.12.019.
41. Remorgida V, Ferrero S, Fulcheri E, Ragni N, Martin DC. Bowel endometriosis: presentation, diagnosis, and treatment. Obstet Gynecol Surv. 2007;62:461–70.
42. Ferrero S, Camerini G, Leone Roberti Maggiore U, Venturini PL, Biscaldi E, Remorgida V. Bowel endometriosis: recent insights and unsolved problems. World J Gastrointest Surg. 2011;3(3):31–8.
43. Vigano P, Candiani M, Monno A, Giacomini E, Vercellini P, Somigliana E. Time to redefine endometriosis including its pro-fibrotic nature. Hum Reprod. 2018;33(3):347–52.
44. Langlois NE, Park KG, Keenan RA. Mucosal changes in the large bowel with endometriosis: a possible cause of misdiagnosis of colitis? Hum Pathol. 1994;25(10):1030–4.
45. Vizzielli G, Cosentino F, Raimondo D, Turco LC, Vargiu V, Iodice R, Mastronardi M, Mabrouk M, Scambia G, Seracchioli R. Real three-dimensional approach vs two-dimensional camera with and without real-time near-infrared imaging with indocyanine green for detection of endometriosis: a case-control study. Acta Obstet Gynecol Scand. 2020;99(10):1330–8. https://doi.org/10.1111/aogs.13866.
46. Habib N, Centini G, Lazzeri L, Amoruso N, El Khoury L, Zupi E, et al. Bowel endometriosis: current perspectives on diagnosis and treatment. Int J Womens Health. 2020;12:35–47.
47. Hudelist G, English J, Thomas AE, Tinelli A, Singer CF, Keckstein J. Diagnostic accuracy of transvaginal ultrasound for non-invasive diagnosis of bowel endometriosis: systematic review and meta-analysis. Ultrasound Obstet Gynecol. 2011;37(3):257–63.
48. Hsu AL, Khachikyan I, Stratton P. Invasive and noninvasive methods for the diagnosis of endometriosis. Clin Obstet Gynecol. 2010;53(2):413–9.
49. Jaramillo-Cardoso A, Shenoy-Bhangle AS, VanBuren WM, Schiappacasse G, Menias CO, Mortele KJ. Imaging of gastrointestinal endometriosis: what the radiologist should know. Abdom Radiol (NY). 2020;45(6):1694–710.
50. Meuleman C, Tomassetti C, D'Hoore A, Van Cleynenbreugel B, Penninckx F, Vergote I, et al. Surgical treatment of deeply infiltrating endometriosis with colorectal involvement. Hum Reprod Update. 2011;17(3):311–26.
51. De Ceglie A, Bilardi C, Blanchi S, Picasso M, Di Muzio M, Trimarchi A, et al. Acute small bowel obstruction caused by endometriosis: a case report and review of the literature. World J Gastroenterol. 2008;14(21):3430–4.
52. Moore JS, Gibson PR, Perry RE, Burgell RE. Endometriosis in patients with irritable bowel syndrome: specific symptomatic and demographic profile, and response to the low FODMAP diet. Aust N Z J Obstet Gynaecol. 2017;57(2):201–5.
53. Iordache IE, Alexandrescu L, Nicoara AD, Popescu R, Leopa N, Baltatescu G, Nelson Twakor A, Tofolean IT, Steriu L. Twisted troubles: a rare case of intestinal obstruction due to endometriosis and a review of the literature. Clin Pract. 2024;14(5):2027–43.
54. Bulletti C, Coccia ME, Battistoni S, Borini A. Endometriosis and infertility. J Assist Reprod Genet. 2010;27:441–7.
55. Gleicher N. Why are reproductive cancers more common in nulliparous women? Reprod Biomed Online. 2013;26(5):416–9.
56. Insabato L, D'Armiento FP, Tornillo L. A rectal endometrioma producing intestinal obstruction. J Clin Gastroenterol. 1994;19:82–4.
57. Arafat S, Alsabek MB, Almousa F, Kubtan MA. Rare manifestation of endometriosis causing complete recto-sigmoid obstruction: a case report. Int J Surg Case Rep. 2016;26:30–3.

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