



Acute Ileo-jejunal Diverticulitis: a 10-Year Single-center Experience

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Abstract

Acute ileo-jejunal diverticulitis (AIJD) is a very uncommon entity with an unknown real prevalence. It usually presents non-specific symptomatology. There is no consensus on the optimal treatment due to the scarcity of studies on the subject. This study aimed to assess the clinical manifestations and short-term outcomes after conservative or surgical treatment for AIJD. A retrospective analytical study was conducted. A search for all patients diagnosed with AIJD in the period between 2009 and 2019 was performed in our center. Demographic, clinical, laboratory, and radiological data were collected. This study aimed to assess the differences between patients who received surgical treatment and those who received conservative treatment. We identified 24 patients with acute ileo-jejunal diverticulitis. A lower rate of surgical treatment was observed in patients with a higher age-adjusted Charlson comorbidity index ($p = 0.038$). There were no statistically significant differences in the demographic, clinical, laboratory, and radiological data according to conservative or invasive management, except in patients in whom an enterolith was identified in computed tomography. All those patients underwent surgical treatment ($p = 0.027$). A higher rate of conservative treatment failure was found at higher stages (Ib, II, and III) of the modified Hinchey classification. Mortality within 30 days of surgery was 12%. AIJD is an uncommon entity with significant mortality rates. In the presence of enteroliths, peri-intestinal or pelvic abscess, and generalized peritonitis, surgical treatment was mandatory. Conservative treatment may be an option in non-severe cases.

Keywords Diverticulitis · Jejunal diseases · Treatment outcome · Comorbidity · Postoperative complications

Introduction

Non-Meckel's small bowel diverticulosis was first described by Baille and von Soemmerring in 1794 [1]. It is a rare condition, especially when compared to diverticulosis of the colon. Its prevalence differs among studies, between 0.3 and 1.9% [2–6] and seems to be higher in the elderly population [7, 8]. A distinction should be made between congenital and acquired diverticula. Meckel's diverticula are the most common congenital diverticula and are present in 0.3–2.9% of the population [9, 10]. Histologically, they are true diverticula and contain all the layers of the intestinal wall [11]. However,

most small bowel diverticula are acquired “pseudo-diverticula,” as they only contain mucosa and submucosa herniated through the muscular layer. Acquired diverticula appear more often in the duodenum [7] and ileo-jejunal diverticula (IJD) represent only a 0.5–2.3% of the small bowel diverticula [4, 12–14].

Oftentimes IJD presents an asymptomatic course. However, it may cause non-specific symptoms or an acute abdomen related to a diverticulitis process, which may associate perforation, obstruction, or bleeding [15]. Other less frequent complications of small bowel diverticular disease are volvulus, intussusception, or malabsorption. Ultrasounds (US) may be useful as a first assessment, but the preferred imaging modality for the diagnosis is the computed tomography (CT) scan [14–16].

Acute ileo-jejunal diverticulitis (AIJD) prevalence is unknown, but mortality rates can reach 40% in severe cases [14, 17]. The diagnosis of AIJD is difficult since sometimes there is no correlation between radiology and intraoperative findings. Furthermore, there is no established definition or classification of AIJD, so it is believed that this entity is

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under-diagnosed [18, 19]. Most authors define AIJD as the presence of a thickened diverticulum with enhanced wall and peri-diverticular fat stranding associating abdominal pain as the key symptom. Due to these facts, the optimal treatment of AIJD remains unclear. Both operative surgical and non-operative treatments have proven to be valid options for the management of these patients, depending on the severity of the clinical case [20].

Despite its potential severity, series describing short-term outcomes from patients with AIJD are uncommon [18, 19, 21]. Additionally, and as far as we are aware, no previous published research described and analyzed the characteristics of the patients undergoing every modality of treatment and their differences. The present study aimed to assess the incidence, clinical manifestations, and short-term outcomes after non-operative or operative surgical treatment for patients with AIJD.

Patients and Methods

A case series analysis was conducted. Historical patient records were analyzed. The searching strategy included patients admitted at the Emergency, Gastroenterology, Internal Medicine, and Digestive Surgery Departments between January 2009 and April 2019. Radiology and pathology reports were also included in the search. Used key terms were “diverticulitis” OR “diverticulosis” OR “diverticulum” OR “diverticular” AND “small bowel” OR “ileojejunal” OR “jejunoileal” OR “ileal” OR “jejunal” OR “intestinal” OR “gastrointestinal.” Radiological findings were retrospectively reviewed by an experienced abdominal radiologist. Exclusion criteria were Meckel’s diverticulum, duodenal diverticulum, bleeding or obstruction without inflammatory findings, volvulus, intussusception, and questionable radiological findings that did not require surgery. For the distinction between Meckel’s diverticula and IJD in patients who did not receive surgical treatment, and therefore no confirmatory biopsy, we rely on the radiological findings: if it was an elongated and unique diverticulum at the antimesenteric intestinal border less than 100 cm from the ileocecal valve, it was considered a Meckel’s diverticulum [10, 22].

We collected demographic data such as gender, age, and history of previous episodes. Age-adjusted Charlson comorbidity index (a-CCI) was used for assessment of comorbidity and life expectancy [23]. Results of the laboratory test included white blood cell (WBC) count, hemoglobin, fibrinogen, C-reactive protein (CRP), and lactate levels. Clinical findings, diagnostic modalities, location, initial and definitive treatment, type of surgery, intraoperative findings, postoperative complications, length of hospital stay (LoHS), and readmissions were also analyzed. Regarding imaging studies, we recorded location, diameter, wall thickness and content of

the diverticulum, the length of the affected intestinal segment, amount of extraluminal gas and free fluid, abscess, and presence of colonic diverticulosis.

IJD was defined as an outpouching that is communicated with the intestinal lumen, regardless of its contents. AIJD was defined as the presence of abdominal pain and the thickening and enhancing of the diverticular wall with peri-diverticular mesenteric fat stranding.

Based on the radiological diagnosis, the modified Hinchey classification proposed by Kaiser et al. [24] was used to assess the severity of the process. Stage Ia was defined as confined peri-intestinal inflammation or phlegmon. Stage Ib included patients with peri-intestinal abscess. Pelvic, distant intraabdominal, or retroperitoneal abscess corresponded to stage II. Generalized purulent peritonitis was defined as stage III. The amount of extraluminal gas and fluid was defined as a “peri-diverticular bubbles” and “peri-diverticular fluid” if there were limited to peri-diverticula inflammation and as a “distant air or fluid” if there was a large amount or distal pneumoperitoneum or fluid.

The non-operative treatment consisted of digestive rest, broad-spectrum antibiotics, and intravenous fluid. Non-operative treatment failure was defined as a change in the clinical course that required operative surgical treatment, including percutaneous drainage or surgery. Clavien-Dindo classification (CDC) was used to classify complications within 30 postoperative days [25]. CDC I–II were considered minor complications and III–V were considered major complications. Postoperative ileus was defined as an interval from surgery until passage of flatus/stool and tolerance of an oral diet ≥ 4 days [26]. LoHS was defined as the number of nights spent in the hospital following admission.

Data analysis was performed by using SPSS® statistical software 25.0.0 version (SPSS, Inc. Chicago, IL, USA). Data were summarized by medians, ranges, counts, and frequencies as appropriate. Non-parametric tests were used to search for differences between treatment groups. For categorical variables, the Chi-square test or the Fisher test were used when necessary. Results with a p -value (p) < 0.05 were considered statistically significant.

Results

We identified 512 patients. Of these, 463 were excluded for being uncomplicated duodenal diverticula reported on endoscopic retrograde cholangiopancreatography or uncomplicated jejunoileal diverticula on CT reports. Twenty-five more patients were discarded. Nine of them were Meckel’s diverticulitis, four were non-inflammatory complications, six were duodenal diverticulitis, and six for an unconfirmed doubtful diagnosis.

Finally, 24 patients met the inclusion criteria. There were 10 men (42%) and 14 women (58%) with a median age of 75.5 (37–94) years. The median a-CCI result was 4 (4–10). A lower rate of operative surgical treatment was observed in patients with a higher a-CCI ($p = 0.038$). Demographic data and clinical findings are outlined in Table 1. Four patients (17%) had a previous episode of AIJD, all of them managed with non-operative treatment. Two cases were jejunal diverticulitis and the other two cases were ileal diverticulitis. In all these 4 cases, the location of the new episode was the same as the previous one.

Twenty-three patients (96%) presented with abdominal pain as the main symptom at the Emergency Department of whom 5 (21%) had generalized abdominal pain. The most frequent location was the epigastric region (6 patients, 25%). Fourteen (58%) patients presented abdominal guarding. Nausea and vomiting were present in 13 (54%) and 8 (33%) cases, respectively. Eight (33%) patients presented diarrhea and 7 (29%) constipation of more than 48 h. Fever over 38 °C was present in only 2 (8%) cases. No statistically significant differences were found between patients who underwent non-operative or operative surgical treatment concerning symptoms or physical examination (Table 1). CRP was elevated in 22 (92%) patients and it the most frequent analytical alteration. Regardless of the treatment received, there were no statistically significant differences in the laboratory findings (Table 2).

Imaging studies were necessary in all cases and their findings are displayed in Table 3. Abdominopelvic CT scan was performed in all cases. The imaging diagnosis of AIJD was achieved in 22 (92%) patients. The other two were diagnosed after surgery. The inflammatory diverticulum was in the jejunum in 18 (75%) cases and the ileum in 6 (25%). The median diameter of the inflammatory diverticulum was 22 (6–70) mm and the median wall thickness was 5 (3–9) mm. The median length of the affected stretch of the small intestine was 5 (1–9) cm. However, 9 (37%) patients presented only one isolated inflamed diverticulum. The content of the affected diverticulum varied considerably. In 4 (17%) patients, there were small peri-diverticular bubbles, indicating micro-perforation of the inflamed diverticulum. In 3 cases (12%), there was distant pneumoperitoneum. There were no differences in radiology according to non-operative or operative surgical management, except for the content of the inflamed diverticulum. All patients in whom an enterolith was identified underwent operative surgical treatment and those with intraperitoneal fluid underwent surgery more frequently ($p = 0.027$) (Table 3).

According to the modified Hinchey classification, 17 (71%) patients presented only diverticulum inflammation (stage Ia). CT scan showed peri-intestinal abscesses of 2, 4, and 8 cm in 3 (12%) cases (stage Ib). One case presented a 10-cm pelvic abscess that required percutaneous drainage (stage II). In 3 (12%) cases, CT scan was compatible with generalized peritonitis (stage III).

Table 1 Demographic characteristics and clinical findings

Data	Total <i>n</i> = 24	Non-operative management <i>n</i> = 10	Operative surgical management <i>n</i> = 14	<i>p</i> -value
Age (median)	75.5 (37–94)	78 (47–91)	71 (37–94)	0.209
Men, <i>n</i> (%)	10 (42%)	3 (30%)	7 (50%)	0.421
Charlson index (median)	4 (0–10)	7 (0–10)	3 (0–8)	0.038
% life expectancy at 10 years (median)	53.3 (0–98)	0 (0–98)	77 (0–98)	0.041
Previous episodes, <i>n</i> (%)	4 (17%)	2 (20%)	2 (14%)	1
Hours until consultation (median)	24 (4–170)	24.5 (7–72)	37.29 (4–170)	0.301
Pain as a main symptom, <i>n</i> (%)	23 (96%)	10 (100%)	13 (93%)	1
Diffuse pain, <i>n</i> (%)	5 (21%)	2 (20%)	3 (21%)	0.678
Abdominal guarding, <i>n</i> (%)	14 (58%)	6 (60%)	8 (57%)	0.889
Palpable inflammatory mass, <i>n</i> (%)	2 (8%)	1 (10%)	1 (7%)	1
Nausea, <i>n</i> (%)	13 (54%)	5 (50%)	8 (57%)	0.729
Vomiting, <i>n</i> (%)	8 (33.3%)	2 (20%)	6 (43%)	0.388
Diarrhea, <i>n</i> (%)	8 (33%)	4 (40%)	4 (29%)	0.673
Constipation, <i>n</i> (%)	7 (29%)	3 (30%)	4 (29%)	1
Fever, <i>n</i> (%)	2 (8%)	0 (0%)	2 (14%)	0.435

Table 2 Laboratory tests

Parameter	Total, median <i>n</i> = 24	Non-operative management, median <i>n</i> = 10	Operative surgical management, median <i>n</i> = 14	<i>p</i> -value
RCP (mg/L)	89 (5–296)	63.5 (11–243)	107 (5–296)	0.379
Fibrinogen (mg/dL)	591 (308–747)	679 (380–720)	576 (308–747)	0.391
Lactate (mmol/L)	1.6 (1–3)	1.6 (1–2)	1.6 (1–3)	0.845
WBC count ($\times 10^9/L$)	13.6 (7–25)	14.2 (7–19)	13 (9–25)	0.901
Bilirubin (mg/dL)	0.7 (0.1–2)	0.6 (0.1–1.5)	0.7 (0.3–2)	0.545
Hemoglobin (g/dL)	14 (9–17)	13 (9–14)	14 (9–17)	0.495

Concerning treatment, 15 (62%) patients were initially managed with non-operative treatment. This treatment failed in 5 (33%) cases. Four of them underwent surgery (two on the second day of admission and two on the third day). One patient required percutaneous drainage on the 7th day after admission due to a collection that was not present at the diagnosis. We performed surgery as initial treatment on 9 (37%) patients. The treatment received and its success according to Hinchey classification are shown in Table 4. A trend towards the failure of non-operative treatment was observed in stages Ib, II, and III, as no patient presented successful non-operative

treatment. However, only one of the patients in stage Ia required surgery after non-operative treatment failure. The time to definitive surgical treatment in those patients in whom non-operative treatment failed was 36 (24–36) h. All the surgeries performed consisted of an exploratory laparotomy with limited resection of the affected segment of the intestine and manual anastomosis, except one patient who underwent surgical drainage.

The most common postoperative complications were nausea and postoperative ileus. Postoperative complications are summarized in Table 5. The median LoHS was 6.5 (3–22)

Table 3 Radiological findings

Parameter	Total <i>n</i> = 24	Non-operative management <i>n</i> = 10	Operative surgical management <i>n</i> = 14	<i>p</i> -value
Location				0.341
Jejunum, <i>n</i> (%)	18 (75%)	9 (90%)	9 (64%)	
Ileum, <i>n</i> (%)	6 (25%)	1 (10%)	5 (36%)	
Affected intestinal segment, median (cm)	5 (1–9)	5 (1–7)	4.7 (2–9)	0.867
Wall thickness, median (mm)	5 (3–9)	5 (3.5–7)	5 (3–9)	0.605
Diameter, median (mm)	22 (6–70)	20 (6–45)	30 (8–70)	0.131
Content				0.027
Gas, <i>n</i> (%)	4 (17%)	3 (30%)	1 (7%)	
Fluid, <i>n</i> (%)	7 (29%)	2 (20%)	5 (36%)	
Enterolith, <i>n</i> (%)	6 (25%)	0 (0%)	6 (43%)	
Semi-solid stool, <i>n</i> (%)	7 (29%)	5 (50%)	2 (14%)	
Extraintestinal gas				0.292
Absence, <i>n</i> (%)	17 (71%)	8 (80%)	9 (64%)	
Peri-diverticular bubbles, <i>n</i> (%)	4 (17%)	2 (20%)	2 (14%)	
Distant air, <i>n</i> (%)	3 (12%)	0 (0%)	3 (21%)	
Extraintestinal fluid				0.291
Absence, <i>n</i> (%)	15 (62%)	7 (70%)	8 (57%)	
Peri-diverticular, <i>n</i> (%)	6 (25%)	3 (30%)	3 (21%)	
Distant fluid, <i>n</i> (%)	3 (12%)	0 (0%)	3 (21%)	
Abscess, <i>n</i> (%)	4 (17%)	0 (0%)	4 (29%)	0.114
Colon diverticula, <i>n</i> (%)	12 (50%)	5 (50%)	7 (50%)	1

Table 4 Treatment distribution according to severity

Stage <i>n</i> (%)	Initial non-operative management <i>n</i> (%)	Non-operative management success <i>n</i> (%)	Need for operative surgical management <i>n</i> (%)
Ia 17 (71%)	11 (65%)	10 (91%)	7 (41%)
Ib 3 (12%)	1 (33%)	0 (0%)	3 (100%)
II 1 (4%)	1 (100%)	0 (0%)	1 (100%)
III 3 (12%)	2 (67%)	0 (0%)	3 (100%)

days. No patients presented recurrence or new symptoms during follow-up. Median follow-up time was 20 (12–26) months. The mortality rate within 30 days was 12%. Regarding the 3 patients who died, they had a median a-CCI of 7 and a median age of 82 years and underwent resection of the affected intestinal segment and anastomosis and the cause in all of them was a multiorgan failure secondary to postoperative sepsis. We did not find any evidence of leakage. There were no recurrences during a 1-year follow-up regardless of whether the patients underwent non-operative or operative surgical treatment.

Discussion

The present results showed a low incidence of AIJD, with only 24 cases in a tertiary center over 10 years but with a remarkable morbidity and mortality rates, which makes the management of these patients a major challenge. The higher prevalence in the elderly population along with the presence of multiple comorbidities in these patients could explain the potential severity of AIJD. Furthermore, this was the first study analyzing the

characteristics of the patients undergoing every modality of treatment and one of the largest series [19]. This evaluation revealed that non-operative management success is closely linked to the absence of enteroliths or intraperitoneal fluid, peri-intestinal or pelvic abscess, and generalized peritonitis.

Clinical presentation varied widely from patients and unspecific symptomatology was present in all cases. Eight patients presented chronic anemia. In a small percentage of patients, diverticular hemorrhage occurs and may be subclinical, causing the anemia. Likewise, although no patient in our series presented malnutrition, it is possible that malnutrition may be present in patients with IJD. Blood analysis showed slight elevations of acute phase reactants, especially CRP, fibrinogen, and WBC count. This leads AIJD to be easily mistaken for other medical conditions such as acute appendicitis, ileus, or perforated peptic ulcer, among others [27]. Jejunal location was 3 times more common than ileal, as it was reported in the literature [19, 27, 28]. Colonic diverticular disease was present in 50% of cases, as a common finding in patients with AIJD [29].

Thus, imaging studies are fundamental and radiologists play a key role [4]. Although US can help initially, a contrast-enhanced CT scan is the most accurate imaging

Table 5 Postoperative complications according to Clavien-Dindo classification

Clavien-Dindo grade	Complications type	<i>n</i> (%)
Minor complications		
I	Pain	7 (50%)
	Nausea	11 (79%)
	Postoperative ileus	7 (50%)
II	SSI (superficial, treated with antibiotics)	3 (21%)
	Pneumonia (treated with antibiotics)	1 (7%)
	SSI (intraperitoneal abscess, treated with antibiotics)	1 (7%)
	Total parenteral nutrition	2 (14%)
Major complications		
IIIa	SSI (intraperitoneal abscess, required percutaneous drainage)	1 (7%)
IIIb		0 (0%)
IVa	Respiratory insufficiency	1 (7%)
IVb	SSI (intraperitoneal abscess, required critical care due to sepsis)	1 (7%)
	Multi-organ failure	2 (14%)
V	Death	3 (21%)

technique to evaluate these patients [4, 19]. In our study, CT scan permitted to reach the diagnosis in 22 of 24 (92%) patients, and in the other 2 was established after surgical treatment. Due to the infrequency of AIJD, its optimal treatment is under discussion and we do not currently have a specific classification for this entity. Despite this, most authors use the modified Hinchey classification, although it has not been validated for AIJD [24]. We showed that staged classifications correlated well with the final management. The totality of patients with AIJD in stages Ib, II, and III required surgery. Non-operative management was successful in 10 (91%) of patients with stage Ia. So, as there is a lack of consensus as to the best management for AIJD, image findings, and their classification together with the clinical condition of the patients should guide the therapeutic approach. Both non-operative and operative surgical (percutaneous drainage or surgery) treatments are available options. We found that patients with enteroliths or intraperitoneal fluid, peri-intestinal or pelvic abscess, and generalized peritonitis required surgery in all cases, as well as 7/17 cases with AIJD stage Ia. Similar results were reported by De Simone et al. [16]. In this study, 74.4 to 78% of patients with complicated AIJD were submitted to surgery. About patients who underwent non-operative management, a-CCI was significantly higher than those with operative surgical treatment.

Postoperative minor complications were very common, but the event of 8 major complications should be noticed. Postoperative morbidity is not well described in the literature, but due to the previous comorbidities and the severity of some cases, high rates are expected. Mortality rates reported in previous studies were between 0 and 14% [30]. The 12% postoperative mortality rate in our study should be interpreted in the context of an elderly population, the presence of multiple comorbidities, and a severe form of presentation. An accurate diagnosis and proper initial management seem to be critical to reducing morbidity and mortality rates.

Due to the retrospective nature of this study and the relatively small sample size evaluated, our results should be considered with caution. Only patients with radiological diagnosis or surgery were included. Consequently, mild forms were probably underdiagnosed and are not well represented. Besides, surgery was not performed in all cases, so the CT scan diagnosis was not always confirmed. Future multi-centric prospective data could be helpful to have a better idea and compare the available management options for AIJD.

In conclusion, AIJD is an uncommon entity that affects the elderly population with multiple comorbidities, with significant morbidity and mortality rates and different therapeutic approaches accepted. In the presence of enteroliths or intraperitoneal fluid, peri-intestinal or pelvic abscess, and generalized peritonitis, operative surgical treatment was mandatory. Non-operative treatment was allowed in non-severe cases with appropriate clinical conditions.

Author Contribution All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Sergio Navarro-Martínez, Juan Carlos Sebastián-Tomás, Nuria Peris Tomás, and José Ángel Díez Ares. The first draft of the manuscript was written by Sergio Navarro-Martínez and all authors commented on previous versions of the manuscript. Computed tomography review was performed by Edgar Lorente-Martínez. All authors read and approved the final manuscript.

Availability of Data and Material Not applicable.

Code Availability Not applicable.

Declarations

Ethics Approval This study was approved by the Ethics and Research Committee of our institution (Code: CEIm 80/20).

Consent to Participate and Consent for Publication Since this is a retrospective study in which there is no information to identify the patients, the ethics committee of our institution approved the exemption of informed consent.

Competing Interests The authors declare no competing interests.

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