

Factors predicting severity level, progression and recurrence risk of acute left colonic diverticulitis in Turkey: A multicenter study

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ABSTRACT

BACKGROUND: Acute left colonic diverticulitis (ALCD) ranges from localized diverticulitis to perforation and fecal peritonitis, and treatment varies from conservative management to emergency surgery. The risk factors for recurrence following nonoperative management of ALCD is still controversial. We aimed to define the factors predicting severity level, progression and recurrence risk of ALCD to timely select patients requiring surgery.

METHODS: This is a multicenter study where patients were included on accrual. Patients in our clinic between December 2017 and June 2019 with ALCD above 18 years of age were included (n=144) in this study, while 18 years and younger, pregnant or nursing mothers, those with Crohn's disease, ulcerative colitis, colorectal and/or anal cancer were excluded from this study. Laboratory parameters, Modified Hinchey Scores, clinical features, demographics, diet, smoking, alcohol consumption, body mass index, previous diverticulitis episodes, chronic diseases of patients with ALCD, as well as recurrences within 18 months after discharge were evaluated.

RESULTS: The findings showed that smoking was more common in patients with previous episodes (p=0.04) and patients who underwent emergency surgery (p=0.04). Recurrence was higher in Modified Hinchey 1b and 2 (p=0.03) than 0 and 1a. Patients who were older than 50y had a higher propensity to undergo emergency surgery than the patients younger than 50y (p=0.049). Nausea, fever, respiratory rate, procalcitonin, total bilirubin and direct bilirubin levels were higher in patients with Modified Hinchey 4 (p=0.03, 0.049, 0.02, 0.001, 0.002, 0.001, respectively). Recurrence was higher in patients with a smoking history, previous ALCD episodes, lower body mass index and pandiverticulitis.

CONCLUSION: Laboratory parameters, body mass index, age, clinical features, previous episodes of diverticulitis and smoking may predict the severity and progression of ALCD. Smoking and having low BMI seem to be precursors of ALCD recurrence, especially when the patient with MHS 1b or 2 had at least one previous episode of ALCD. Control colonoscopy results are predictive of recurrence.

Keywords: Acute diverticulitis; inflammation; left colon; predictors; progression; recurrence.

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INTRODUCTION

Approximately 10–25% of individuals with diverticular disease face acute left colonic diverticulitis (ALCD) at least once in life.^[1] Changing lifestyles and dietary habits with more consumption of low fiber food- has been suggested to cause escalating rates of ALCD in the young generation (<50y). Lower left abdominal tenderness is a finding and an increase in C-Reactive Protein (CRP) (>5 mg/dl diagnostic) and abdominal CT is the absolute diagnostic gold standards of the disease.^[2] Approximately for four decades, ALCD severity has been categorized by Hinchey classification; however, recently, researchers have suggested alternative modifications.^[3,4] Some researchers evaluated complicated ALCD patients in two age groups as younger and older than 50y, while others focused on the presence of obesity.^[5–7] Chautems et al.^[7] advocated the necessity of surgery for patients who had the first episode before the age of 50, as they believed this group faced the risk of complications as high as 54% after the second episode. Other authors pointed out escalating morbidity and mortality after the second and later episodes.^[8,9] Although majority of patients recover by conservative management on the first episode, surgery becomes inevitable when medical treatment fails.^[9,10]

Inflammation indicators may guide inexperienced physicians and surgeons in diagnosis.^[11] Käser et al.^[2] advocated that high serum CRP levels indicated diverticular perforation in ALCD. Procalcitonin (PCT) is a diagnostic parameter in the inflammatory response and its plasma level is directly proportional to the severity of inflammation.^[12] Its importance in ALCD has not been well defined. The literature on acute appendicitis points out that Gram-negative bacteriae transport through the intestinal mucosa to portal venous and hepatic system via bacteriemia and endotoxemia to inhibit bile transport mechanism, causing cholestasis and an increase in serum bilirubin levels.^[13] However, the presence of the same mechanism is debatable in ALCD.

In this study, we aimed to establish the role of white blood cell count (WBC), CRP, PCT, hyperbilirubinemia in the indication of the severity level of ALCD and assess the importance of clinical features, gender, age, socioeconomic status, body mass index (BMI), diet, smoking, alcohol consumption, chronic diseases, hemorrhoids and anal fissure in predicting progression and recurrence risk of ALCD.

MATERIALS AND METHODS

This study was conducted in accordance with the Amended Declaration of Helsinki. The study protocol was approved by the local ethics committee in our institute. Informed consent was obtained from all patients upon admission. This was a multicenter study where patients were included on accrual. Five research and training hospitals with university affiliations from various regions of Istanbul, Turkey, contributed to this study.

Records of 144 patients admitted with ALCD between December 2017 and June 2019 were evaluated. Patients above 18 years of age admitted for ALCD were included in this study, while 18 years old and younger, pregnant or nursing mothers, those foreknown for Crohn's disease, ulcerative colitis, colorectal and/or anal cancer were excluded from this study. Absolute neutrophil count (ANC), percent of neutrophils (N%), WBC, CRP, PCT, total (TB) and direct bilirubin (DB) were recorded on admission. Clinical features (fever (>37.5°C), nausea, pulse, blood pressure (BP), respiratory rate (RR)), demographics, socioeconomic status, diet, smoking and alcohol consumption, BMI, previous ALCD episodes, hemorrhoids, anal fissure, chronic diseases were noted on admission.

Initial diagnosis of ALCD was based on left lower abdominal pain and increased serum CRP and WBC. All patients underwent abdominal CT with IV contrast. Modified Hinchey Score (MHS) was utilized to define the severity of ALCD. Emergency surgery was performed in patients with diffuse peritonitis, septic shock, or if the clinical parameters got worse in 2–3 days of conservative treatment. Percutaneous drainage (PD) under ultrasonography (USG) was performed for abscesses of 4 cm in diameter or larger. Oral intake was stopped on admission, IV antibiotics (3rd generation cephalosporin/metronidazole) started and continued as per disease duration. Empiric administration of wide-spectrum antibiotics on admission was the general routine of the participating clinics; however, infectious disease specialist consultations were obtained with blood culture for complicated ALCD patients who did not respond to the initial antibiotic regimen within the first week of hospitalization. All laboratory studies were repeated for patients who were still not discharged at the end of the first week. Emergency operations, PD, complications were recorded. Recovered patients were prescribed oral ciprofloxacin+metronidazole for the first week of discharge, and they underwent control colonoscopy five weeks after discharge. Recurrences of ALCD within 18 months were recorded.

Laboratory parameters: Normal ranges and units were: WBC: 4–11×10⁹ cells/L, ANC: 2–8×10⁹ cells/L, N%: 55–70, CRP: 0–1 (mg/dl), PCT: <0.1 (ng/ml), TB: 0.3–1.0 (mg/dl), DB: 0.1–0.3 (mg/dl).

Socioeconomic status and education: Economical status was defined by monthly income: 1. No income (dependant on social services), 2. Minimum wage, 3. Middle income, 4. High-income group. Educational level was defined as 1. Illiterate, 2. Primary school, 3. Secondary school, 4. High school, 5. University graduate or above.

Diet: Patients' dietary habits were classified as: 1. Plant-based (mostly vegetables, fruits, grains and seeds, less than 1 serving of meat, fish or poultry per week); 2. Meat-based (more than 1 serving of meat, fish or poultry per meal every day,

and a trace of plants); 3. Balanced (1 serving of meat, fish or poultry, and at least 400 g of plant-based food per day) diet.

Chronic diseases: Presence of chronic renal failure (CRF), congestive heart failure (CHF), liver failure (LF), renal or liver transplantation (R/LTx), irritable bowel syndrome (IBS), malignant neoplasia (M), diabetes mellitus (DM), immune deficiency (ID) of other reasons, corticosteroid treatment (CRx) were recorded.

BMI: BMI was defined in kg/m² and patients were classified as normal weight (>18.5–25), overweight (>25–30), obese (>30–35), extreme obese (>35–40), and morbidly obese (>40) according their BMI.

Recurrence: Recurrence was defined as any readmitted new ALCD episode within 18 months after discharge.

Statistical Analysis

Relationships between categorical variables were tested by the Fisher-Freeman-Halton test. Kolmogorov-Smirnov test was used for the normality test of continuous variables. Differences among the levels of categorical variables concerning continuous variables were compared using ANOVA model. When the results were significant, Post-Hoc Tukey test was used. $P < 0.05$ was accepted statistically significant. SPSS (ver. 25) was used for all calculations. Risk factors of the disease severity were determined by using multiple ordinal logistic regression with stepwise variable selection methods. Multivariate analysis was not applied to the factors which were related to recurrence because recurrence was seen in a very small sample of patients.

RESULTS

Of the 144 patients, 74 were male (51.4%), 70 were female (48.6%), and the mean age was 54.7SD15.1. There was no difference between patients with previous ALCD and without, concerning gender and age ($p=0.96$).

Socioeconomic and educational status were not correlated with disease recurrence ($p=0.93$ and 0.36 , respectively) or MHS ($p=0.71$ and 0.69 , respectively).

Chronic disease pattern was as DM ($n=17$), CHF ($n=12$), IBS ($n=11$), cured M (breast cancer $n=2$, lung cancer $n=1$, basal skin cancer $n=1$), previous CRx ($n=2$), CRF, LF, Tx and ID ($n=0$). The difference between patients with and without previous ALCD episodes concerning chronic diseases was not significant ($p=0.96$).

Smoking was significantly more common in patients who underwent surgery, and in patients with at least one previous episode ($p=0.04$); MHS was not affected by smoking ($p=0.72$). Only seven patients were alcoholics and alcohol consumption was not correlated with having previous ALCD episode or MHS ($p=0.58$ and 0.33).

The differences between patients with diverse dietary habits concerning having previous ALCD episodes ($p=0.64$) or MHS ($p=0.57$) were not significant.

Out of 144 patients, 35 had hemorrhoids (24.3%) and 14 had anal fissure (9.7%). Previous ALCD episodes and MHS were not related to hemorrhoids ($p=0.94$ and 0.97 , respectively). Again, previous ALCD episodes and MHS were not related to anal fissures ($p=0.96$ and 0.73 , respectively).

Conservative therapy only (n=136): Out of 144 patients, 136 recovered with medical treatment only (Table 1).

Percutaneous drainage (n=2): Patients who underwent PD had abscesses of 4cm diameter each, on the colonic wall and in the pelvic cavity, respectively, both recovered with medical treatment after PD (Table 1).

Emergency surgery (n=8): Patients who underwent emergency surgery had significantly higher pulse ($p=0.004$),

Table 1. MHS, treatment modality, surgery type, complications, recurrence: DL was performed by abdominal irrigation and insertion of the drain as the sigmoid perforation was closed by the omentum; LS was performed by the end to side anastomosis without creating a stoma

MHS	Medical treatment: 136	Surgical treatment/Procedure		Recurrence: 8	Complications: 2
		Emergency: 8	PD: 2		
0	14	0	0	0	–
Ia	109	DL:1, HP:1	0	1	–
Ib	8	0	1	4	–
II	5	0	1	3	–
III	0	HP:2	0	0	1 E in HP
IV	0	HP:3+LS:1	0	0	1 E in HP

MHS: Modified Hinchey Score; PD: Percutaneous drainage under ultrasonography; HP: Hartmann's procedure; DL: Diagnostic laparoscopy; LS: Laparoscopic sigmoid colectomy; E: Evisceration.

Table 2. Body mass index and treatment modality: Normal weight and overweight patients had a higher tendency to undergo emergency surgery than obese, extremely obese and morbidly obese patients

Body mass index (kg/m ²)	Emergency surgery	Medical treatment	Total
Normal (>18.5–25)	4	19	23
Overweight (>25–30)	4	55	59
Obese (>30–35)	0	48 (No recurrence)	48
Extreme obese (>35–40)	0	10 (No recurrence)	10
Morbidly obese (>40)	0	4 (No recurrence)	4

Table 3. Biochemical parameters on admission: Univariate analysis demonstrated that patients with MHS 1b had significantly higher CRP levels on admission than MHS 1a and 0. Mean PCT, TB and DB on admission were significantly higher in patients with MHS 4

	MHS	N	Mean	SD	P
CRP mg/dl	0	14	9.3936	8.37003	0.003
	1a	111	7.9551	6.37979	
	1b	8	20.1480	9.68444	
	2	5	12.5875	11.24549	
	3	2	12.6234	11.11367	
PCT ng/ml	0	14	0.4093	0.55193	0.001
	1a	111	0.2464	0.31000	
	1b	8	0.3480	0.34716	
	2	5	0.3825	0.43177	
	3	2	1.3201	1.3471	
TB mg/dl	0	14	1.0793	1.23043	0.002
	1a	111	1.9589	6.46169	
	1b	8	0.5800	0.31544	
	2	5	1.1575	0.88925	
	3	2	3.1367	1.7462	
DB mg/dl	0	14	0.4229	0.62596	0.001
	1a	111	0.6351	2.55564	
	1b	8	0.2360	0.11908	
	2	5	0.4825	0.34942	
	3	2	2.8346	1.4738	
	4	4	9.9900	19.34298	

MHS: Modified Hinchey Score; CRP: C-reactive protein; PCT: Procalcitonin; TB: Total bilirubin; DB: Direct bilirubin; SD: Standard deviation.

RR ($p=0.001$), N% ($p=0.001$), ANC ($p=0.004$), CRP ($p=0.049$), PCT ($p=0.001$), TB ($p=0.01$), DB ($p=0.002$), but lower BMI ($p=0.01$) on admission, compared with medically treated patients. Patients older than 50y had a higher propen-

sity to undergo emergency surgery than the younger patients ($p=0.049$). Emergency surgery was performed in MHS 1a, 3 and 4. Hartmann procedure was applied to six patients, while one patient underwent laparoscopic sigmoid colectomy with end to side anastomosis without stoma creation. Diagnostic laparoscopy with abdominal irrigation and drain insertion was performed to one patient (Table 1). All colostomy reversals were completed in three to five months following initial surgery without any complication.

Complications (n=2): Eviscerations within the first week of conventional HP were recorded in 2 patients with DM who had MHS 3 and 4 (Table 1). These patients underwent fascial repair.

BMI and recurrence of ALCD: Patients with previous ALCD episode had significantly lower BMI than the ones without an episode, recurrence was significantly higher in patients with lower BMI ($p=0.01$) (Table 2).

Colonoscopy findings and recurrence of ALCD: Patients with 'pancolonic diverticuli' in control colonoscopy had significantly higher recurrence ($p=0.02$).

MHS and recurrence of ALCD: Patients with MHS 1b and two had significantly higher recurrence than MHS 0, 1a, 3 and 4 ($p=0.03$). 1 patient with MHS 1b who recovered under conservative treatment was readmitted in one month with MHS 4 and underwent emergency surgery. Otherwise, none of MHS 1b and two patients who had recurrence required emergency surgery.

MHS and biochemical parameters: Univariate analysis demonstrated patients with MHS 1b had significantly higher CRP levels on admission than MHS 1a and 0 ($p=0.003$). Mean PCT, N%, TB and DB on admission were significantly higher in patients with MHS 4 ($p=0.001$, 0.02, 0.002, 0.001, respectively) (Table 3). Multivariate analysis showed CRP and DB were indicators of severity ($p=0.001$, 95% CI=0.036–0.147, OR=1.094, and $p=0.002$, 95% CI=0.047–0.218, OR=1.41, respectively).

MHS and clinical parameters: Patients with MHS 4 had significantly higher levels of temperature and RR on admission ($p=0.03$).

Recurrence and previous episodes: Recurrence of ALCD was recorded in only eight out of 144 patients. Multivariate analysis was not applied to the factors which were related to recurrence because of the very small sample of patients with recurrence.

Within 18 months of follow-up, recurrence was recorded in one patient after his first ALCD episode. The remaining seven recurrence were noted in patients who had more than one previous episode. Patients with previous ALCD had a significantly higher recurrence rate than patients with no previous episode ($p=0.03$). Overall recurrence was 5.56%, the recurrence rate after the first episode was 1.35%, and after multiple episodes were 10%.

DISCUSSION

The role of inflammation markers in predicting perforation in ALCD is described in the literature.^[2,13,14] Mäkelä et al.^[15] demonstrated that CRP value over 150 mg/l and advanced age were independent risk factors for complicated ALCD. A CRP value over 150 mg/l and free abdominal fluid in CT were variables predicting postoperative mortality. Our results revealed that MHS Ib patients had significantly higher CRP levels on admission than MHS Ia and 0 ($p=0.003$). Multivariate analysis showed CRP was an indicator of severity ($p=0.001$, 95% CI=0.036–0.147, OR=1.094).

Jeger et al.^[16] concluded that it was possible to differentiate between complicated and uncomplicated ALCD with PCT levels in combination with abdominal CT, and PCT could be used in guiding treatment and reducing antibiotic usage. The median PCT level for uncomplicated ALCD was significantly lower than complicated ALCD. Ido et al.^[17] showed PCT levels in uncomplicated ALCD were in the physiologic range, and >0.1 ng/ml in complicated ALCD. Our results revealed MHS four patients had higher PCT levels than all other MHS groups ($p=0.001$); however, in multivariate analysis, PCT was not an independent indicator of severity.

Käser et al.^[2] suggested that isolated hyperbilirubinemia without much elevation in liver enzymes could be referred to as predict diverticular perforation. The risk of perforation was significantly higher in ALCD patients with TB values >2.1 mg/dl. We recorded that mean TB and DB values on admission were significantly higher in patients with MHS 4 than the other MHS groups ($p=0.002$, and 0.001 , respectively). Multivariate analysis showed DB was an indicator of severity ($p=0.002$, 95% CI=0.047–0.218, OR=1.41). We conclude that isolated hyperbilirubinemia without much elevation in liver enzymes can be utilized in adjunct to abdominal CT to predict the severity level of ALCD.

Literature suggests N% is more accurate than CRP, WBC and ANC in predicting the need for intervention. This biomarker is cost-effective, readily assessed and useful when combined with CT.^[14] We recorded that patients with MHS 4 had the highest N% value.

Our study supports the importance of high ANC, N%, CRP, PCT, TB and DB values in the late stages of ALCD (MHS 3, 4). Appropriate utilization of these laboratory parameters in combination with abdominal CT may help us to better estimate the severity level of ALCD, thus timely eliminating the patients who require emergency surgery.

Nikberg et al.^[18] identified low education level as a risk factor for ALCD. Our study did not reveal any correlation between socioeconomic or educational status and recurrence or severity of ALCD.

In both men and women, heavy smokers (≥ 15 cigarettes a day) had a 1.6 fold increased risk of developing the symptomatic diverticular disease compared with non-smokers.^[19] Our results showed that smoking was significantly more common in patients who underwent emergency surgery and in those with at least one previous episode.

Literature suggests a strong correlation between diverticulitis and obesity, especially in the young population.^[20] Benjamin et al.^[21] demonstrated that underweight patients undergoing emergency abdominal surgery had increased morbidity and mortality. While class III, obesity was associated with increased morbidity, overweight and class I obesity were protective. In support of this, Beresneva et al.^[22] showed overweight status had a protective effect on mortality after surgery for diverticulitis. After controlling for demographics, comorbidities, the severity of illness, treatment group, and duration of antimicrobial therapy, Dietch et al.^[23] concluded that obesity was not independently associated with treatment failure of intraabdominal infections. Our data are consistent with the above, supporting the existence of the obesity paradox. In our study, patients with previous ALCD episodes had significantly lower BMI (25.39SD3.80 kg/m²) versus without episode (29.15SD4.32 kg/m²). Recurrence was significantly higher in patients with lower BMI. In addition, none of our obese, extremely obese and morbidly obese patients needed surgery. Medical treatment was sufficient for recovery. Surgery was mandatory for only four normal and four overweight patients (Table 2). Our results suggest that excess intraabdominal fat may prevent the progression of ALCD, perhaps as a means to plug microperforation on the colonic wall. However, as the visceral fat area has been proposed as an alternative to BMI for assessing the impact of obesity and fat distribution, alternative studies focusing on the influence of visceral fat on diverticulitis severity should be planned.

Higher consumption of dietary fiber, especially from whole fruit, was linked with lower diverticulitis risk in women.^[24] Tursi et al.^[25] advocated that red meat intake was associated with increased risk, while higher fish consumption was associated with reduced risk of diverticulitis. Our results did not reveal any difference between dietary habits concerning either recurrence or severity of ALCD.

The presence of hemorrhoids and anal fissure were also found unrelated to ALCD.

Patients with chronic diseases and immunosuppression are at increased risk of having complicated diverticulitis. Most of these patients require emergency surgical intervention, which is associated with higher mortality rate. Elective sigmoid resection after an episode of ALCD has been recommended in immunocompromised patients.^[26] Biondo et al.^[27] recorded that the rate of emergency surgery in immunosuppressed patients with ALCD was 39.3% and this type of surgery was needed more frequently in the chronic CRx group. Postoperative mortality was 31.6% and the recurrence rate after medical treatment was 27.8%. They concluded that the etiology of immunosuppression did not influence mortality and recurrence. We did not record any severely immunosuppressed patient in our study group, and our results did not reveal any relationship between chronic diseases and recurrence. Only two of the diabetic patients who underwent HP had evisceration within the first week of surgery.

Medical treatment generally cures ALCD abscesses <4 cm diameter. For bigger abscesses, CT or USG guided PD is recommended.^[3] Durmishi et al.^[28] reported that PD was successful in 75% of Hinchey 2 diverticulitis abscesses and 35% of the patients were cured using elective surgery. We performed PD on two patients (MHS 1b and MHS 2) who had both abscesses of 4cm, and they recovered under medical treatment.

We recorded overall recurrence as 5.56%, recurrence rate after the first episode as 1.35%, and recurrence after multiple episodes as 10%, which supported the finding of El-Sayed et al.,^[29] who concluded that the rate of hospital admission for recurrent acute diverticulitis was 11.2%. Patients with MHS 1b and 2 had significantly higher recurrence than MHS 0, 1a, 3 and 4. Most likely explanation for this will be the presence of abscesses and higher severity of MHS 1b and 2 than MHS 0 and 1a. Also, Al Harakeh et al.^[30] observed in their series the presence of intraabdominal abscess strongly correlating with higher rate of recurrence after nonoperative treatment of diverticulitis. We did not record recurrence for MHS 3 and 4 patients, most likely due to performed emergency resections of the diverticulitis zones. Patients with previous ALCD had a significantly higher recurrence rate than patients with no previous episode.

Conclusion

Laboratory parameters, advanced age, clinical features, BMI, previous ALCD episodes, smoking on admission are informative parameters in predicting severity and progression of ALCD; gender, socioeconomic features, diet, coexisting hemorrhoids and anal fissure do not seem to be factors involved in the severity and progression of ALCD. Control colonoscopy results are predictive of recurrence. Recurrence tends to be more frequent, especially in case of smoking and low BMI, in addition to MHS 1b or 2 with one previous episode

of ALCD. Treatment of ALCD has to be patient-based with special attention to high-risk patients.

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REFERENCES

- Mäkelä J, Vuolio S, Kiviniemi H, Laitinen S. Natural history of diverticular disease: when to operate?. *Dis Colon Rectum* 1998;41:1523–8.
- Käser SA, Fankhauser G, Glauser PM, Toia D, Maurer CA. Diagnostic value of inflammation markers in predicting perforation in acute sigmoid diverticulitis. *World J Surg* 2010;34:2717–22.
- Hinchey EJ, Schaal PG, Richards GK. Treatment of perforated diverticular disease of the colon. *Adv Surg* 1978;12:85–109.
- Klarenbeek BR, de Korte N, van der Peet DL, Cuesta MA. Review of current classifications for diverticular disease and a translation into clinical practice. *Int J Colorectal Dis* 2012;27:207–14.
- Biondo S, Parés D, Martí Ragué J, Kreisler E, Fracalvieri D, Jaurrieta E. Acute colonic diverticulitis in patients under 50 years of age. *Br J Surg* 2002;89:1137–41.
- Schauer PR, Ramos R, Ghiatas AA, Sirinek KR. Virulent diverticular disease in young obese men. *Am J Surg* 1992;164:443–8.
- Chautems RC, Ambrosetti P, Ludwig A, Mermillod B, Morel P, Soravia C. Long-term follow-up after first acute episode of sigmoid diverticulitis: is surgery mandatory?: a prospective study of 118 patients. *Dis Colon Rectum* 2002;45:962–6.
- McGuire HH Jr. Bleeding colonic diverticula. A reappraisal of natural history and management. *Ann Surg* 1994;220:653–6.
- Efron JE, Noguera JJ. Controversies in diverticular disease: indications for surgery and surgical options. *Semin Colon Rectal Surg* 2000;11:206–13.
- Bahadursingh AM, Virgo KS, Kaminski DL, Longo WE. Spectrum of disease and outcome of complicated diverticular disease. *Am J Surg* 2003;186:696–701.
- Chung CH, Ng CP, Lai KK. Delays by patients, emergency physicians, and surgeons in the management of acute appendicitis: retrospective study. *Hong Kong Med J* 2000;6:254–9.
- Mengüçük ME, Ayten R, Bülbüller N, Gödekmerdan A, Başbuğ M, Mungan İ. Role of C-reactive protein, procalcitonin and neopterin in the diagnosis of acute appendicitis. *Firat Med J* 2010;15:40–3.
- Chaudhary P, Kumar A, Saxena N, Biswal UC. Hyperbilirubinemia as a predictor of gangrenous/perforated appendicitis: a prospective study.

- Ann Gastroenterol 2013;26:325–31.
14. Reynolds IS, Heaney RM, Khan W, Khan IZ, Waldron R, Barry K. The Utility of Neutrophil to Lymphocyte Ratio as a Predictor of Intervention in Acute Diverticulitis. *Dig Surg* 2017;34:227–32.
 15. Mäkelä JT, Klintrup K, Takala H, Rautio T. The role of C-reactive protein in prediction of the severity of acute diverticulitis in an emergency unit. *Scand J Gastroenterol* 2015;50:536–41.
 16. Jeger V, Pop R, Forudastan F, Barras JP, Zuber M, Piso RJ. Is there a role for procalcitonin in differentiating uncomplicated and complicated diverticulitis in order to reduce antibiotic therapy? A prospective diagnostic cohort study. *Swiss Med Wkly* 2017;147:w14555.
 17. Ido F, Lina M, Tegeltija V, Kulairi Z. Procalcitonin in Uncomplicated Diverticulitis (ProUD). *Am J Gastroenterol* 2018;113:81–2.
 18. Nikberg M, Ji J, Leppert J, Sundquist K, Chabok A. Socioeconomic characteristics and comorbidities of diverticular disease in Sweden 1997–2012. *Int J Colorectal Dis* 2017;32:1591–6.
 19. Humes DJ, Ludvigsson JF, Jarvholm B. Smoking and the Risk of Hospitalization for Symptomatic Diverticular Disease: A Population-Based Cohort Study from Sweden. *Dis Colon Rectum* 2016;59:110–4.
 20. Faria GR, Almeida AB, Moreira H, Pinto-de-Sousa J, Correia-da-Silva P, Pimenta AP. Acute diverticulitis in younger patients: any rationale for a different approach?. *World J Gastroenterol* 2011;17:207–12.
 21. Benjamin ER, Dilektaşlı E, Haltmeier T, Beale E, Inaba K, Demetriades D. The effects of body mass index on complications and mortality after emergency abdominal operations: The obesity paradox. *Am J Surg* 2017;214:899–903.
 22. Beresneva O, Hall J. Influence of body mass index on outcomes in patients undergoing surgery for diverticular disease. *Surg Open Sci* 2019;1:80–5.
 23. Dietch ZC, Duane TM, Cook CH, O'Neill PJ, Askari R, Napolitano LM, et al. Obesity Is Not Associated with Antimicrobial Treatment Failure for Intra-Abdominal Infection. *Surg Infect (Larchmt)* 2016;17:412–21.
 24. Ma W, Nguyen LH, Song M, Jovani M, Liu PH, Cao Y, et al. Intake of Dietary Fiber, Fruits, and Vegetables and Risk of Diverticulitis. *Am J Gastroenterol* 2019;114:1531–8.
 25. Tursi A. Dietary pattern and colonic diverticulosis. *Curr Opin Clin Nutr Metab Care* 2017;20:409–13.
 26. Sartelli M, Catena F, Ansaloni L, Coccolini F, Griffiths EA, Abu-Zidan FM, et al. WSES Guidelines for the management of acute left sided colonic diverticulitis in the emergency setting. *World J Emerg Surg* 2016;11:37.
 27. Biondo S, Trenti L, Elvira J, Golda T, Kreisler E. Outcomes of colonic diverticulitis according to the reason of immunosuppression. *Am J Surg* 2016;212:384–90.
 28. Durmishi Y, Gervaz P, Brandt D, Bucher P, Platon A, Morel P, et al. Results from percutaneous drainage of Hinchey stage II diverticulitis guided by computed tomography scan. *Surg Endosc* 2006;20:1129–33.
 29. El-Sayed C, Radley S, Mytton J, Evison F, Ward ST. Risk of Recurrent Disease and Surgery Following an Admission for Acute Diverticulitis. *Dis Colon Rectum* 2018;61:382–9.
 30. Al Harakeh H, Paily AJ, Doughan S, Shaikh I. Recurrent Acute Diverticulitis: When to Operate?. *Inflamm Intest Dis* 2018;3:91–9.

ORJİNAL ÇALIŞMA - ÖZET

Türkiye’de akut sol kolon divertikülitinin şiddet, progresyon ve nüksüne etkili faktörler: Çok merkezli çalışma

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AMAÇ: Akut sol kolon divertiküliti (ASKD) klinikte lokalize divertikülden perforasyon ve fekal divertiküle varan geniş bir yelpazede görülebilir; tedavi hastalığın şiddetine göre konservatif yöntemlerden acil cerrahiye kadar değişkenlik gösterebilir. Akut sol kolon divertikülitinin ameliyatsız tedavisini takiben görülebilen nüksüne neden olan risk faktörleri hala tartışmalıdır. Bu çalışmada, cerrahi tedavi gerektiren hastaların uygun zamanda belirlenmesine yönelik olarak ASKD şiddet, progresyon ve nüksünü belirleyici faktörlerin tanımlanmasını amaçladık.

GEREÇ VE YÖNTEM: Çalışmamız çok merkezli ve ileriye yönelik olarak gerçekleştirildi. Kiliniğimizde aralık 2017–Haziran 2019 tarihleri arasında klinik, laboratuvar ve görüntüleme yöntemleriyle ASKD tanısı konularak yatışlı tedavisi yapılan (n=144) 18 yaş üzeri hastalar çalışmaya dahil edildi, 18 yaş ve daha genç, gebe veya emziren, önceden tanısı konulmuş Crohn, ülseratif kolon hastalığı, kolo-rektal ve/veya anal kanalda malign tümörü mevcut fakat ameliyat edilmemiş hastalar çalışmadan dışlandı. Hastaların yatış esnasındaki laboratuvar parametreleri, Modifiye Hinchey Skoru (MHS), klinik özellikleri, demografi, beslenme, sigara ve alkol alışkanlıkları, vücut kütle indeksleri (VKİ), önceki divertikülit atakları, mevcut kronik hastalıklarının yanısıra taburculuktan itibaren 18 ay içindeki divertikülit nüksleri kaydedildi.

BULGULAR: Sigara içme alışkanlığı önceden divertikülit atağı geçirmiş (p=0.04) veya acil cerrahiye alınmış (p=0.04) hastalarda anlamlı olarak daha fazla görüldü. Nüksetme, MHS 1b ve 2 de, 0 ve 1a'dan anlamlı olarak yüksekti (p=0.03). Acil cerrahi girişim yapılan hastalar incelendiğinde 50 yaş üzeri hastaların, daha genç hastalardan anlamlı olarak fazla olduğu görüldü (p=0.049). Yatış esnasında bulantı, ateş, solunum sayısı, prokalsitonin, total bilirubin ve direkt bilirubin seviyeleri MHS 4 olan hastalarda, diğer hastalara göre anlamlı olarak daha yüksek bulundu (sırasıyla, p=0.03, 0.049, 0.02, 0.001, 0.002, 0.001). Nüksetme, sigara içme alışkanlığı, önceden ASKD öyküsü, düşük VKİ ve pandivertikülit mevcudiyeti olan hastalarda diğer hastalara göre yüksekti.

TARTIŞMA: Laboratuvar parametreleri, VKİ, yaş, klinik özellikler, önceden geçirilen divertikülit öyküsü ve sigara kullanımı, ASKD'nin şiddet ve seyri hakkında belirleyicidir. Önceden en az bir ASKD atağı geçirmiş olan MHS 1b-2 hastalarda sigara alışkanlığı ve düşük VKİ mevcudiyeti ASKD nüksüne yatkınlık oluşturmaktadır. Kontrol kolonoskopi sonuçları nüksetme olasılığı hakkında yönlendiricidir.

Anahtar sözcükler: Akut divertikülit; enfamasyon; predictor; progresyon; nüksetme; sol kolon.